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The Geographical Journal

Vol. LIX No. 3 March 1922

A RECENT JOURNEY TO NORTHERN LABRADOR

G. M. Gathorne-Hardy

Read at the Meeting of the Society, 5 December 1921.

I PROPOSE to-night to give some account of a visit which I paid to the northern parts of the Labrador coast in the autumn of last year. I was accompanied by my cousin, Robert Gathorne-Hardy, who had at the time only just left Eton, but whom I chose because I knew him to be keenly interested in archæology, and it was an archæological problem which I proposed primarily to investigate. Now, on a closer acquaintance, I should be puzzled to name any subject in which my cousin was not keenly interested, and I feel I could not, therefore, have had a more suitable or delightful companion.

The journey itself was neither exciting nor arduous; it was no such undertaking as the expedition into the interior which I had the pleasure of sharing with Mr. Hesketh Prichard in 1910. Of this, as its details have long since been published, I do not intend to say much here. Such interest as may attach to what I have to say must depend firstly upon the archæological problem which I went to Labrador to tackle, and also upon the circumstance that the northern parts of this coast are perhaps sufficiently little known to warrant the occasional attention of this Society. A good deal has, no doubt, been written about it, and public interest in it has to a great extent been awakened and kept alive by the energetic propaganda of Dr. Wilfrid Grenfell. At the same time, apart from those connected with the Moravian Mission, and the Hudson's Bay Company, together with the Newfoundland schoonermen, there are very few who have seen it at all, and fewer still to whom it can be said to be at all well known. Of the interior, of course, not even this can be said. It is not particularly easy for the ordinary traveller to get even so far north as Nain. The mail-boats from Newfoundland contract, I believe, to come as far north as this point twice in their season, but no one can exactly tell when these visits will be made. There is, indeed, a very small boat which now carries the mails and a travelling magistrate from Newfoundland to the more northern stations, but this does not supply much accommodation for unofficial passengers, and would be looked askance at by those for whom sea-sickness holds any terrors at all.

To give an idea of the inacessibility even of such a place as Nain, I may mention the experience of a Newfoundland canoeman, who accompanied Mr. Hesketh Prichard and myself in 1910. This man came from Newfoundland to Glasgow, and thence to London, from which port he sailed after some little delay by the Moravian Mission ship *Harmony*, a boat of 250 tons, with a speed in favourable circumstances of about 5 knots—not, therefore, an Ocean greyhound. In this way he came with us eventually to Nain, and found on his arrival that he could not have got there directly from his own country until considerably later. This, I suppose, must be nearly the most roundabout journey on record.

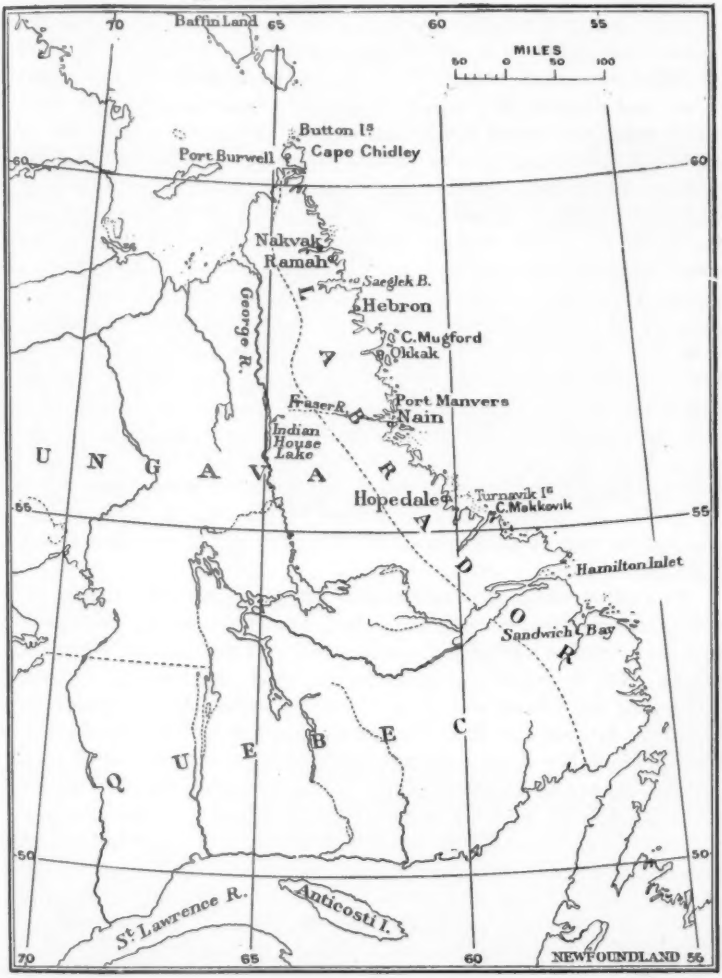
Politically, Labrador is divided between the interior, which belongs to Canada, and the coast, which is a dependency of Newfoundland. When I was there, the precise line of delimitation was a matter of acute controversy, which was about to come before the Privy Council for adjudication.

Apart from this political division, there is a considerable distinction in character to be drawn between the northern and southern parts of the coast. For rough purposes, one may divide the two at Hamilton Inlet. From this point southwards is the country of the white settlers, in fairly regular touch with Newfoundland, and forming the principal though not the exclusive field for the ministrations of the mission associated with the name of Dr. Grenfell. The northern part is the country of the Eskimo, who have been controlled and cared for for 150 years by another mission, that of the Moravians. It is only to this northern half that my personal experiences extend.

Physically, the coast of Labrador presents a considerable resemblance to that of Norway, though it is much more bleak and desolate. There is the same high interior plateau, falling steeply to the sea, and intersected by long fjords and narrow, deep-cut river-valleys. The water in the fjords is generally very deep, so much so that it is often difficult to find satisfactory anchorage at a safe distance from the shore. As in Norway, the coast is fringed with islands, which form in certain places, especially in the neighbourhood of Nain, a very considerable archipelago. The plant-life also resembles that of Norway; one may specially mention the berries known in Norway as *tyttebaer* and *multebaer*, both of which are exceedingly common in Labrador.

The main cause, of course, which keeps Labrador secluded is ice: the drift ice from the north in the early summer, and the freezing of the sea in the early winter. I have not myself encountered this obstacle, except in the comparatively harmless form of bergs, but it is, nevertheless, a very real impediment to navigation. Once you are on the coast of Labrador, the principal obstacle to enjoyment in the early summer is the mosquito, of which pest much has been written and said; but what has been written is inadequate, and what is said is unfit for publication, so we may pass this aspect of the question over in silence.

Apart from this very real drawback, and several other more or less imaginary ones existing in the minds of questioners, I am often asked what attractions are to be found in Labrador. There can be no question,



Sketch-map of Labrador.

I think, that there are attractions: it is the common experience of practically all who have visited the country that they seek and desire to return to it. Frankly, I do not think much of its sporting or commercial possibilities. As regards the former, there are certainly large herds of

very fine caribou, but it would be difficult for a visitor to remain in the country where these are generally to be found much after the time when the horns are clean. Recently the Newfoundland Government have thought fit to impose and enforce their game laws. As a rule I approve of such a policy, but I must say that in this case I feel that some modification is advisable. The deer have a natural protection in the difficulties of inland travel, and the incalculable changes in the course of their migrations; and they certainly exist in very large numbers, as the wide, worn roads which one comes across demonstrate. By far the greater part of the slaughter is done by the Indians of the far interior, in Canadian territory, largely out of reach of any conceivable application of game-laws, and I consider that the very sparse resident population of the coast might be allowed to kill for their own food supply—and even to preserve the meat—whenever and wherever they get the chance of coming across the game. Of course, it would be the easiest possible thing for the natives to evade the law with impunity; only the extreme candour and truthfulness of the Eskimo stand in the way; and I regret a policy calculated to have a detrimental effect on these good qualities. A prohibition against commercial use and export would, it seems to me, in the circumstances be sufficient. At present feeling on the coast runs very high, and as, so far as I can ascertain, the population is not represented in the Newfoundland legislature, I think it desirable to voice the general view.

Besides the caribou, black bears exist in considerable numbers, and small game, such as ducks, geese, willow-grouse, etc., is abundant at the right time of year.

As regards commercial possibilities, fish (cod) and seals remain, as always, the principal resources exploited, though fur-trading, principally in foxes, is carried on during the winter with very variable and uncertain results. The fishing is mainly conducted by the natives from summer stations on the islands and other remote points, as well as by the Newfoundland fishermen in their ubiquitous schooners. The difficulties of transport and the short open season impede the exploitation of such minerals as have been found to exist in Labrador, while timber is almost non-existent north of Nain, and what there is seems to be of exceptionally slow and uncertain growth, so that it is doubtful whether, once despoiled of existing wood, the country would recover; at any rate, I have seen places where timber formerly existed which show no sign, after a considerable lapse of time, of ever bearing it again. My experience of the interior, even in the latitude of Nain, is that away from the river valleys it is almost incredibly barren. One has the greatest difficulty in finding even a few twigs of dwarf birch to feed a fire which needs constant replenishing, and a piece of real wood, however stunted, is so rare as to be a godsend indeed.

To the traveller with scientific instincts, however, the attractions of Northern Labrador are undeniable. The natural history of the fauna has

KILLINEK MISSION STATION

FRAZER RIVER NEAR NAIN

TRIBUTARY VALLEY FROM THE BARREN PLATEAU

MUGFORD TICKLE CLIFFS

been pretty thoroughly done, though I should imagine that a competent naturalist would still find plenty to interest him, and not a little useful work remaining. Botany seems to be the science which appeals most generally to the resident missionaries, and one of them—Mr. Hettasch of Nain—is a mine of knowledge on the subject; I hope he may be induced some day to give the public the benefit of his researches. The geology of the country seems to me to offer a promising field, as is perhaps natural in a country whose bare bones are so conspicuously displayed. To a casual observer like myself, the features most striking are the raised beaches and the traces of glacial action. Labrador is undoubtedly rising from the sea at a very considerable rate. All along the coast-line, wherever it is not altogether precipitous, raised beaches are to be seen, frequently several of them at different levels. I may here, perhaps, mention a sort of raised beach of a different character which I met with in the interior on my former journey with Mr. Hesketh Prichard. This was on the hillside above the Indian House Lake of the George River, and, being about 700 feet above the present level of the water, and far inland, cannot be explained in the same way. It has been suggested to me that this beach was an example of a lateral moraine. I am afraid I am not a sufficiently expert geologist to deal with the point; all I can say is that it looked exactly like a level beach of clean and conspicuous gravel. I am under the impression that moraines are more irregular both in composition and in level. I imagined that the true explanation of this feature was the same as that given for the "Parallel Roads of Glenroy" in Scotland, viz. that a glacier in former ages blocked the valley, causing the water to rise to a level far above that which it keeps at present.

Though there are now, curiously enough, no glaciers in Labrador, other traces of geologically recent glaciation are to be met with everywhere. In the interior one sees esker ridges, like railway embankments, running roughly east and west. On the coast all hills, below a certain height, particularly in the neighbourhood of Nain, seem to have the shape of exaggerated boulders crowned with numerous perched blocks. At one point when approaching Nain one comes across a very conspicuous stone of this sort, stuck, with no visible means of support, halfway up a smooth steep slope of rock. Captain Jackson of the Moravian Mission ship told us that he had endeavoured to persuade a stranger that the Eskimo had started rolling this boulder up the hill, but had grown tired and left it where it lies. As the block is the size of a small house, the yarn must have taken some swallowing!

One more characteristic feature which deserves notice is to be seen in most of the bays, but perhaps at its best about Okkak. This is due to the agency of forces still operative, and consists of a solid wall of stranded boulders at some little distance from the shore, forced into postiion by the sea-ice, and called by the settlers and schoonermen "bally carters," a corruption, evidently, of barricadoes.

Where the mountains grew higher, especially about Cape Mugford and north of Okkak, the coast scenery is really fine, the form of the tops being much more peaked and jagged; these, I imagine, were the original peaks, projecting above the level of the glaciers. This type of scenery extends pretty nearly to the northern extremity, but in the extreme north, around Killinek or Port Burwell, it becomes tame again, depressingly barren, without much picturesqueness. Here again one meets the perched blocks, but the characteristic feature of this locality is the tremendous rise and fall of the tides. At the landing-place one steps ashore at one time, and at another one has to scramble up a sort of cliff. Another feature is the number of narrow rifts with parallel precipitous sides, mostly of no great height. In extreme cases, narrow straits or "tickles" seem to have been formed in this way, and in one place near the station of Port Burwell there is a very narrow, steep-sided fjord of this character.

At Port Burwell, when I was there, the long-standing boundary dispute between Newfoundland and Canada had come to a head. Canada was running the customs, and Newfoundland the Post Office, so that some Canadian police, who had just been introduced, had, I suppose, to contribute to the Newfoundland revenue if they wished to write home. I fancy the grounds of dispute must have originated long ago at home, through some official who did not know the country trying to solve the problem by means of an inaccurate map and a ruler.

Passing from geology, I may point out that Labrador provides exceptional opportunities for the observation of the aurora borealis. The name seems to me something of a misnomer, seeing that in a latitude scarcely further north than that of Glasgow one frequently sees the bands and streamers in any and every quarter of the heavens. Two points occur to me as worthy of mention in this connection. The first is, that I have occasionally seen what appears to be the aurora by day, in the form of faint clouds having the characteristic appearance of the bands and streamers. The second point I raise with some hesitation, as I believe the balance of scientific opinion is against its possibility. This is, that, judging merely by the evidence of my senses, I should say that I had sometimes *heard* the aurora, when in rapid movement, making a faint, crisp, rustling noise. If this is a hallucination, it is a very strange one. I notice that the Manual for the Arctic expedition of 1875 recommends the observer who suspects such a phenomenon to "brush off spicules of ice from the neighbourhood of his ears, his whiskers," etc. In the conditions to which I am referring, neither spicules of ice nor whiskers were present. Still, I would not dogmatically assert that I could not be mistaken, but merely give my evidence for what it is worth.

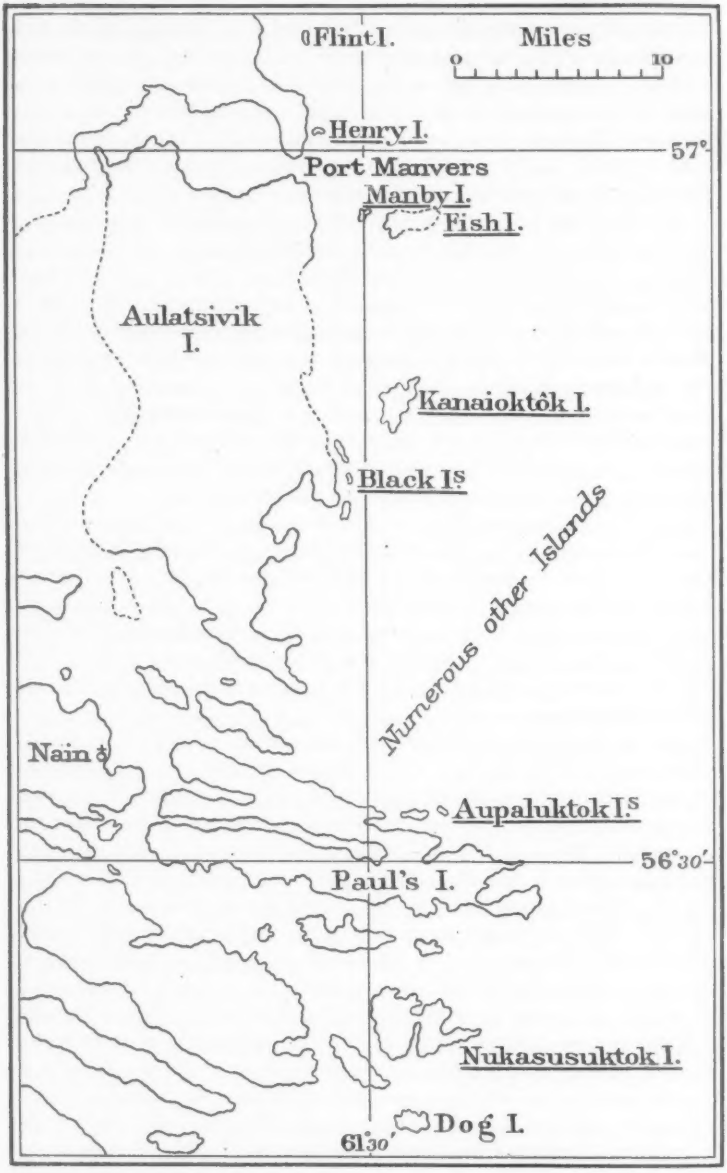
From a strictly geographical standpoint, there is plenty of scope for work, and of this we did a certain amount as opportunity arose. Considering the inadequacy and inaccuracy of the existing chart, and the fact that the interior, except for a few traverses, is practically unsurveyed, there

is in this respect almost a virgin field. With the exception of my friend Captain Jackson of the Moravian Mission, who is extremely careful and scientific, those who navigate these waters, skilful as they are, are rather primitive in their methods. A story is told of a mail-boat captain who, being in thick weather off Belle Isle, hailed a passing liner to find out his position. This was given him in the ordinary way, "latitude so and so, longitude such and such." To which his only reply was, "To hell with your latitude and longitude; I want to know where I'm to."

It is, I think, because so much of the navigation is of this character that the positions usually assigned to certain places on the coast often depend upon obsolete observations. The present chart contains an inset plan of Port Manvers, dated 1808. This, though apparently pretty correct in its general features, is entirely wrong in its orientation; indeed, I think whoever copied the original sketch must have made a confusion between true and magnetic north. It looks as though the original was drawn to true bearings, and then supposed to have been drawn to magnetic. Anyhow, the error is so striking that one could almost detect it without instruments. The bearings which we took do not pretend to minute accuracy, but they are, I think, quite sufficient to establish the point.

Again, in the case of Nain, one of the best-known settlements on the coast, Captain Jackson and I satisfied ourselves by repeated observations and every check we could think of that the true longitude is far nearer 61° 52′ 35″ W. than the accepted position 61° 41′ 41″. Of course, since Nain is approached for a long way through narrow channels between islands, no one, except in the interests of academic accuracy, is likely to take an observation there, and a position nearly a century old might easily remain unchallenged.

But to my mind the principal attractions of the coast are in the fields of ethnology and archæology. At the present moment, among the Eskimo of Northern Labrador, one is a spectator of the last hours of a dying culture. Even in the last ten years the change has been extremely noticeable. When I was in Labrador in 1910, the kayak with its appliances was in common use as far south as Hopedale, below latitude 55° 30′. Now you will not see one till you get to Hebron, in latitude 58° 13′. The kerosine-driven motor-boat has supplanted the native craft, and only the Eskimo name for kerosine, "orksualuk," or nasty blubber, survives to remind us that until quite recently the natives held erroneous ideas as to the proper use of this fluid. Even in the far north, it is plain that the existing facts of to-day will be the archæology of to-morrow. The old sealskin dress is rarely seen, and, worse than this, in spite of the devoted efforts of the Moravian missionaries, the Eskimo themselves seem a dying race in these regions. The outbreak of Spanish influenza in 1918 practically exterminated the flourishing settlement of Okkak; every adult male perished, and nearly all the grown women. It was pathetic to notice all round that neighbourhood the fishing huts of the natives with all the



Sketch showing position of Kanaioktôk and other Tunnit Islands in Nain district. Islands where remains are found or reported, underlined.

gear lying about, suggesting a catastrophe almost as sudden as the destruction of a city in a volcanic eruption. This calamity has been followed this year, I am sorry to learn, by the total destruction by fire of the mission buildings at Nain. Though this is not so tragic an occurrence, the hardship involved must necessarily be considerable.

But the shrinkage of the native population has been going on for a much longer period. When Lieut. Curtis made a census of the Eskimo in 1773, he began at the Straits of Belle Isle. When Captain Cartwright, about the same time, was keeping his famous diary in the neighbourhood of Sandwich Bay, he had ample opportunities of studying the natives in that locality. Now, if one wishes to see Eskimo one must begin north of Hamilton Inlet, and the further north the better.

More pleasant, but equally eloquent of comparatively recent change, is the alteration in the character of the inhabitants. When the first Moravian missionaries, in 1752, tried to found a station, the ruins of which have recently been discovered in the neighbourhood of the present settlement of Makkovik, their leader, with the captain and five of the crew of the ship which brought them, was murdered by the Eskimo. Undeterred by this failure, the mission returned a few years later, and, thanks to its efforts, the Eskimo of Labrador is now as peaceful and truthful a Christian as one could wish to meet. The quality of truthfulness, indeed, he carries to almost absurd lengths. If he makes an accidental misstatement, he will apologize for telling a lie, and I am told that if he asks for credit at the store and his request is refused but on further consideration granted, he will not express gratitude, but will say, "Why did you tell me a lie at first?"

But my point here is that, as was to be expected, the traces of a life so recently extinct are everywhere to be met with, together with the remains of the not much earlier stone age, which may serve to throw light on similar articles to be met with elsewhere throughout the world. I am confident that if the archæology of Labrador were investigated with the same scientific thoroughness which has characterized this class of work in Greenland, results of almost equal interest could be obtained.

With Eskimo remains, however, I was only indirectly concerned, as something likely to throw light on the main problem which I was anxious to investigate. This was that of the "Tunnit," an extinct race, said to be of non-Eskimo origin, remains of whose stone buildings were alleged to exist on various islands off the Labrador coast. References to Eskimo tradition on the subject of this race are to be found in various authorities, and it has been suggested, especially by Mr. W. G. Gosling in his book on Labrador, that the ruins might be connected with the early Norse visits to America. This theory seemed to find some support in the fact that when the Moravian bishop Martin showed some Eskimo the illustrations in Nordenskjold's book of the Norse remains in Greenland, they asserted that these resembled the "Tunnit" ruins to be found on the

Labrador islands. I may say at once that this was a mistake, and that the resemblance can only have been of the most superficial character. As the subject of the Norse voyages to America is one in which I have been for many years keenly interested, it was natural that I should wish to investigate the problem on the spot, the more so as I could not find on inquiry that, beyond the collection of a certain number of Eskimo legends on the subject, anything had yet been done in this direction. I believe that such photographs as I can show are the first which have been taken of any of the ruins themselves.

I did not myself believe that these ruins could have anything to do with the earliest voyages described in the sagas, but I thought it possible that when the Greenland colony fell on evil times, as it did before its final extinction in the early fifteenth century, some venturous spirits might have tried to find a more desirable home in the lands discovered by their predecessors.

I am anxious to concern myself rather with facts than theories to-night; I will not therefore go into such questions as the significance of the name "Tunnek" or "Tunnit," about which a good deal might be said. The evidence of tradition supplies the following data: the Tunnit were a race, few in numbers, but in stature and physique superior to the Eskimo, whose central habitat appears to have been the archipelago about Nain and Port Manvers. The mutual attitude of Eskimo and Tunnit was hostile, and the Tunnit were gradually driven north towards Baffin Land, where again they are mentioned in popular tradition. Except for a colony at Nachvak, which was mentioned to Mr. E. W. Hawkes while he was preparing his monograph on the Labrador Eskimo, they seem to have lived exclusively on islands, a circumstance which led Rink, in his 'Tales and Traditions of the Eskimo,' to suggest "this looks as if ancient settlers of European race are hinted at." They are said to have used weapons of slate and hornstone, and the most persistent part of the tradition maintains that they clothed themselves in sealskin with the blubber attached, which, I take it, means that they were inferior to the Eskimo in the art of dressing skins. The word "Tunnek" is now applied by the natives to a very dirty man, much as one says, "a Hun" or "a Vandal." All one can say is, that if they struck heathen Eskimo as dirty they must have been the last word in squalor.

I may add that the tradition as reported by the earliest missionaries constantly speaks of the Tunnit as "Greenlanders," and connects them with that country, but I cannot help thinking that this idea was based on a misunderstanding on the part of the original questioners as to the meaning of the word "karalit," which seems also to have been occasionally applied to this people.

Having said so much, it seems best to refer directly to the remains themselves, and to compare them with the relics of primitive Eskimo culture to be found in the same region.

The usual site for an ancient Eskimo settlement, of which we saw several, is upon the low neck or isthmus of a promontory providing two alternative means of access to the sea, in case one of them should be unduly exposed to the weather. Kivalek, near Okkak, is a typical specimen. The settlement of Kivalek figures in quite old Eskimo legends, and appears not to have been occupied for over one hundred years. In such a spot will be found the ruins of the old turf houses, the characteristic plan of which is either a rude oval or an oval with one flattened side. From the curved side, facing the south, runs a long narrow passage or tunnel, forming the entrance. This feature is so characteristic that it is retained, in the form of a sort of porch, even in the wooden huts occupied nowadays by the natives at the more civilized stations. Where, as at Killinek in the north, the old form of house has undergone less modification, this passage, which is partly used as a kennel for the dogs, is even more clearly maintained.

The summer camping sites are chosen on similar ground, and are marked by the disconnected ring of stones originally used as ballast for the tent. Occasionally traces will be seen of a kind of pavement of flat stones, which I took to be a hearth, but was informed was used mainly for cutting up seals.

On adjacent headlands will be found the graves. It is sometimes rather inaccurately stated that the primitive Eskimo method of burial consists merely in covering the body with a heap or cairn of stones. The process is really more elaborate than this. Even when a grave is empty, or contains nothing more than a few bones, it still keeps its hollow form. It consists of a low wall of stones built round the body, and roofed in with some rocks long enough to reach right across. Near the grave will be found a somewhat similar structure about a foot square (internal measurement), containing, or formerly containing, the gifts or offerings left with the dead. Sometimes a few articles will be found in the grave itself. As the positions of burial-places near former settlements are well known, and the graves themselves distinctly conspicuous, the gift-chambers have, in practically all cases, been rifled of their more valuable contents, though there are still numerous articles of archæological interest to be gleaned from them. Until recently, the superstition of the natives caused them to insert some other article by way of exchange, so that the presence of iron nails or a broken fishing reel is not to be taken as evidence of recent date. None of these graves is really modern.

Perhaps a richer mine for objects of archæological interest is to be found in the turf walls and floors of the old houses, or in the surrounding turf and adjacent middens. In such places I and my cousin, Robert Gathorne-Hardy, who has a *flair* for such things, discovered a good many of the old stone weapons; in at least two places also, at Saeglek and Killinek, we were lucky enough to find places where formerly the manufacture of such things had been carried on; here the ground was plenti-

fully littered with flakes, and we found several implements, complete or fragmentary. With only two exceptions, all the relics of the Eskimo stone age found by us consisted of chipped, unpolished implements, made principally from a kind of cloudy quartz, and occasionally of other similar stones giving the required flint-like, conchoidal fracture. The same characteristics were observed in the collections of various missionaries. The exceptions were a small weapon-point of ground slate, and what appeared to be a partially polished axe or adze-head of a hard black stone; one of the Eskimo regarded it as a whetstone. These things were certainly not typical of the local culture. There were also the usual implements of bone and walrus ivory, and a few ornaments of pierced copper.

Turning now to the Tunnit, the normal site for their buildings presents a remarkable contrast to that favoured by the Eskimo. As I have said, all that we saw or heard of were on islands, many of which are inaccessible for small boats except in the calmest weather. Moreover, such remains as we saw, and others of which we heard, are placed on the most exposed sides of these islands, facing for the most part rather away from than towards the mainland. The sites are otherwise uncomfortable, consisting of raised beaches of large boulders, and these appear to have been used even though far more attractive camping-sites existed in the immediate neighbourhood. The sole advantages which they seem to possess are the presence of plenty of building material on the spot, and the fact that the structures so closely resemble their surroundings as to be provided with a sort of *camouflage*. This fact renders it extremely difficult to give a proper idea of them by means of photographs.

On these boulder beaches are found, firstly, tent-circles of a somewhat different type from the normal Eskimo, being built of larger stones in close contact with one another. This type has been found among the more ancient Eskimo remains in East Greenland, where indeed the stone ruins investigated by the late Mylius Ericson and Mr. Thostrup (see *Meddelelser om Grönland*, vol. 44) show many points of resemblance to the Tunnit remains of Labrador. The diameter is about 10 feet. There are also a number of structures with higher walls, regarded by the Eskimo as shelters or houses. A large specimen measured 17 feet 6 inches by 10 feet, another 15 feet by 9 feet 6 inches internally. Most were somewhat smaller. Many are of a strictly rectangular plan. The floors had been levelled by clearing away the large stones. The walls seen were about 2 feet high, and did not appear ever to have been much higher. I heard, however, of one, on a small island near Port Manvers, where I was unable to land, which must have been at least 4 feet 6 inches in height, as my informant, a somewhat diminutive Eskimo named Michael Atsertatajok, or "tomtit," stated that he could not see over it. The walls had evidently never consisted of any other material besides the stones, and great care and experience must have gone to the construction of such dry stone

THE BARREN INTERIOR PLATEAU

BARRENS AND LAKES OF THE INTERIOR

ESKER RIDGE ON INLAND LAKE

ICE-BORNE ROCK BARRIER NEAR OKKAK

RAISED BEACH NEAR INDIAN HOUSE LAKE

TUNNIT BUILDING

walls, seeing the excellent condition in which many of them remain at the present day. In no case was there a trace of any dwelling with the characteristic passage entrance.

One specimen was seen of a different kind of shelter, which is also to be found upon the Turnavik Islands, near Makkovik, where use has been made of a shallow cave in a cliff, which shows traces of building in front of it. Besides dwellings, there were numerous small structures of a similar character, which I take to have been depôts or caches for meat and other property. Some of these were attached to the larger buildings. Whale-bones abounded, and it was evident that the pursuit of these animals was an important part of the Tunnit economy. Now, as Mr. E. W. Hawkes has pointed out, the Eskimo themselves build stone structures both as hunting blinds and meat caches, but I would emphasize the fact that the Tunnit ruins appear to me to be very different. They are of a much more regular form, the stones are far larger and more artistically fitted together, and I may support my own view with the general opinion of the natives that these structures do not resemble Eskimo handiwork.

Of special or exceptional objects there were a few which seem to merit attention. In one place there were pairs of stones arranged in a perfectly straight line, four pairs in all, occupying a total length of 21 feet 9 inches. This we took to be some sort of boat rest; but it was unsuitable for a kayak, and rather suggested a craft with a keel. Possibly, however, it was intended for some wholly different purpose. In another place there was a stone table, which seemed to me to resemble a similar structure described by Mr. Thostrup in East Greenland. It may have been used for cutting up meat, or perhaps, as Thostrup suggests, for keeping it out of the way of animals, though I rather doubt its efficacy for the latter purpose. In this connection I may mention that an Eskimo informed us that we should find large stones to which the Tunnit used to bind captives, so that they were, as he expressed it, "all same rock." Unless he was referring to some such structure as this, we were not able to confirm this report.

Of particular interest were two sections of wall whose siting suggested that they were intended as breastworks for defensive purposes. They were too far from the shore for hunting blinds, and seemed evidently meant to be manned, as there was a cleared floor on the landward side. They were built on high ground along the crest of a slope, commanding a direct view towards Mount Thoresby and the mainland by Port Manvers. Altogether there were about 30 yards of wall, divided by a gap of about 50 yards into two nearly equal portions. The end furthest inland terminated in a sort of shelter, facing the col over which we had come from one collection of ruins to another.

We were unsuccessful in finding anything which was certainly a Tunnit grave, though I am inclined to think that a structure built on the Eskimo principle, but with unusually few and large stones, which was close to a

Tunnit settlement, was of this description. Nor did we find any weapons or implements. I think our failure in this respect was due to the care we took not to disturb the ruins. We did, however, procure from an old Eskimo a number of articles which he had taken from what he at any rate regarded as the gift-chamber of a Tunnit grave. It was certainly in a Tunnit locality, and the unusual size and character of the grave and chamber were considered by the finder to be evidence of Tunnit origin. The weapons included in the find were markedly different from such Eskimo stone-work as came under our observation, being made of ground slate and, in four cases, of a harder stone, finely ground and polished. This use of slate appears to be common among the Eskimo of Greenland and elsewhere, though it has been regarded as a late phase, contemporary with the, at any rate occasional, use of iron. In Labrador the use of ground as opposed to chipped stone appears to be very exceptional, and the natives and missionaries agreed in regarding the weapons of this find as unlike anything in their experience. It will be remembered that the Tunnit are traditionally credited with the manufacture of implements from slate, and altogether I am inclined to think that this find really represents the Tunnit culture. But if so, either the theory ascribing a comparatively late date to such things is incorrect, or the Tunnit must have existed on the coast up to a far later period than is usually supposed. Considered generally, the Tunnit culture seems pronouncedly Eskimo, though of a different type from that commonly found on the coast of Labrador.

And yet, on consideration, the theory that the Tunnit were merely another Eskimo tribe does not appear satisfactory. All along the Labrador coast, where several different Eskimo tribes existed, the Tunnit are consistently treated by tradition as something not Eskimo, but contrasted with that race. Further, when we refer to Baffin Land, whither the Tunnit seem eventually to have retired, we find, as Dr. Boas has recorded in his paper on the Central Eskimo, that there too, among quite different tribes, they are regarded in the same way, as aliens. The legendary accounts of their strength and size, coupled with numerical weakness, tell in the same direction, and these are to some extent corroborated by the size of the material used by the Tunnit in making their shelters, etc. For that type of building one would not, presumably, use material that could not be handled with considerable ease.

Consider again the matter of their boats. Legends relating to the Tunnit after they were driven north, both at Nachvak and in Baffin Land, state that they had no boats of their own, but depended on theft from the Eskimo. Now an island folk like the Nain archipelago colony of Tunnit, who evidently made an extensive practice of whale-hunting, must necessarily have used boats, though the kind of shore which they favoured does not appear very suitable for the kayaks of the Eskimo. If they were a mere Eskimo tribe, which had had boats and lost them, they could easily make fresh ones. But if, like other nations, they had elaborate

wooden boats, if these were wrecked or lost and the owners driven north, they could not be replaced in that treeless country.

One other point. If these Tunnit were a primitive Eskimo race, ultimately expelled by a later immigration of more highly civilized tribes of the same stock, one would expect these later comers, working down the coast from the north, would push the primitives further and further south. But the story of the Tunnit is just the reverse; they were pushed north. On the other hand, if the Tunnit did not arrive on the coast until the normal Eskimo were already in occupation, they could hardly have pushed past them as far as the Nain archipelago. The existence, then, of the headquarters of the Tunnit on islands halfway down the Labrador coast looks as if they had come there direct from oversea; in fact, as tradition seems to assert, from Greenland.

What then are the data? A people Eskimo-like, but regarded as alien; seamen, but ultimately without boats; dressed like savages in skins, which, unlike savages, they could not clean or prepare properly. There was blubber on the skins. Their weapons, though of stone, differed apparently from the local culture, and were of a type usually associated in Greenland, where it occurs, with some knowledge of metal prototypes. Finally, a race physically bigger and stronger, but numerically weaker, than the surrounding Eskimo.

Such is the problem. It is for others to solve it; I will do no more than point, in the most guarded language I can, to a possibility which does not seem to me to be altogether excluded. If the Tunnit were not Eskimo, then what fits the facts is an Eskimoized race, living across the sea, and capable of crossing it. This brings one back to a modification of the suggestion we discarded at the outset. It is a widely accepted theory, adopted by Dr. Nansen, that the Norse colony of Greenland was ultimately fused, by neglect and hard times, with the Eskimo civilization. Any part of it which survived must necessarily have undergone this change, since as Norsemen its members disappeared. Here you have a race, largely Eskimoized, but not Eskimo, accustomed to sea voyages, and most probably with some knowledge of the western side of the Atlantic. Bearing in mind the discredit brought upon the study of the first voyages to America by previous suggestions of Norse remains, I do not feel inclined to appear definitely to advocate this fancy by developing the argument further. I have tried to show that an interesting problem exists, and to give some results of a preliminary investigation. But I venture to hope that it will not be allowed to rest where it is, but that some one with more time, better opportunities, and a greater special knowledge may be tempted to pursue it further.

Before the paper the PRESIDENT said: I have much pleasure in introducing to you Mr. Gathorne-Hardy, a distinguished student of Oxford, President of the Union in his time, and a wide traveller, who will describe a recent visit to Labrador.

Mr. Gathorne-Hardy then read the paper printed above, and a discussion followed.

The Hon. ROBERT GATHORNE-HARDY: When I was watching the aurora borealis I heard nothing. One of the missionaries told me he had heard it, and the sound was like a "rush"—which I imagine to mean like a rush of wind. On a windy night the wind would sometimes go in the same direction as the streamers of the aurora. This might account for his statement. I never noticed any crackling sound: it is obviously not universal.

The general impression I got when in Labrador was the great field there is for research of all sorts and particularly for archæology. But in a short time valuable work will be difficult, for the Eskimo are quickly dying out and it will soon be impossible to get their help in identifying what is found. The "Tunnit" remains are different from those of the Eskimo and not like any others, but it is significant that many of the buildings are rectangular. This is a peculiarity of civilized buildings as opposed to those of savages. One would not be surprised to see many of the remains in wild parts of Scotland. They are like the ruins of small cottages, and have got the stamp of being the work of people who are something more than savages but in a decadent state. It is difficult to say anything about the implements found. Even if they are Tunnit, the arrows are made on the same plan as those of the Eskimo, being flat on one side, with a ridge down the other.

Apart from archæology there is much research to be done in Labrador. There can be but few countries where the effect of ice-action is to be seen so well. In Greenland the ground is covered up with ice, but in Labrador it is as if the ice had been peeled off yesterday, and often the rocks are still polished. The tall mountains are rugged, showing that they have escaped glaciation; the lower hills and islands are all rounded by ice. On their smoothed surfaces are many erratic blocks. These have probably come from the high mountains, which seem to have supported snowfields and glaciers. These mountains are lower than formerly, for the land has sunk and there are many drowned valleys. It is now rising again, as is shown by the raised beaches, which are extremely common and sometimes stretch uninterruptedly for about 100 feet up the land. The most important study is the natives, because they are dying out so quickly that in thirty years' time little could be learnt from them about their remains.

Dr. J. W. EVANS: One of the most surprising features of Labrador and the region to the west of it is the almost complete disappearance of the glaciers that once covered the country. It is not because the climate is too mild. If you go down one of the mines you will find 50 feet below the surface it is still freezing hard in the middle of summer. The reason why the glaciers have disappeared seems to be that the snowfall is very much diminished. This is probably due to some change in the meteorology of the northern Atlantic—some change in the direction of the prevalent wind and sea currents. There must have been a very heavy snowfall in the region, and only that is required to produce a great glaciation of the country. In the case of Greenland, the extreme glaciation which occurs now, which is apparently greater than existed a few centuries back, is entirely due to the persistence of an area of low pressure off the east coast which is accompanied by rain or snowfall, especially snowfall. It would be very interesting to work out what must have been the changes in the distribution of pressure in the North Atlantic. The subject has been dealt with by Mr. Harmer of the Geological Society, but it is at present very largely a matter of speculation.

The PRESIDENT: I suppose most of us had the impression beforehand, and

from seeing those slides, that Labrador is a very barren and desolate and uninteresting country, but the lecturer has succeeded in showing us how many attractions and interests there are, though I shall be disposed to agree with him and his cousin that the chief interest lies in the people themselves. It is terrible to think of one settlement having been entirely swept away by the influenza, and of the people elsewhere disappearing. It is all the more important, therefore, that some one should go over there now and record carefully and scientifically the customs, manners, and habits of this fast-disappearing people. That quality of truth to which Mr. Gathorne-Hardy referred, is very often much more frequently met with amongst primitive people than civilized ones. One meets it amongst the forest peoples of India and hears of it in the islands of the Pacific. I suppose really, if you went into it, it is probably more natural for mankind to be truthful than to lie. Lying is a habit they acquire in the course of their civilization. I am sure you will wish me on your behalf to thank the lecturer for the lecture he has given us, and his cousin for his most interesting remarks.

SOME NOTES ON PHOTOGRAPHIC EQUIPMENT AND METHODS FOR TRAVELLERS

Captain J. B. L. Noel

Read at the Afternoon Meeting of the Society, 12 *December* 1921.

THE following notes, compiled from experience in the field, are offered as an addition to those instructions already contained in the Society's 'Hints for Travellers.' They deal with portability of apparatus, with suggestions for improving the efficiency and simplicity of development in the field. Travellers are expected to produce photographs of a high standard. It is hoped that the following notes, without going too deeply into the technicalities of the subject, will help those particularly who are single-handed and have no very specialized knowledge.

The object is to advise on the judicious selection of apparatus—the first essential in the production of good work—and to demonstrate a simple and very efficient method of developing negatives, which will ensure success and much improve the general standard of results.

Selection of Apparatus.

The guiding consideration is to combine portability with such a design of apparatus as will permit of all the usual branches of photography being undertaken. These are landscape and architectural photography; telephotography; natural colour photography; instantaneous photography; panoramic photography; kinematography.

It is possible to obtain a single camera which will combine all the first five functions, but it will be necessarily a complicated bit of apparatus to operate in the field; and most travellers will find it more convenient to provide themselves with three separate types of cameras: a landscape

stand camera adapted for wide-angle work and also telephotography; a small-size camera (preferably of fixed focus) for instantaneous photography where portability is the first consideration; and a panoramic camera.

The modern anastigmatic lens has effected a complete revolution in the selection and design of apparatus. It now permits the use of very small plates without loss of definition in the image, with the consequent gain of portability, economy of cost, and handiness of operation in the field. The modern anastigmatic lens is so perfect in its optical qualities that it can render a better definition on a quarter-plate, subsequently enlarged to whole plate, than the old-pattern lens could give by direct impression and printing from the whole plate. The definition of modern anastigmatic lenses is perfect even at the extreme apertures at which they may be used. This can be realized by considering the result produced by the extremely small cinematograph picture only 1 inch by $\frac{3}{4}$ inch in size, photographed with a lens at an aperture of F/3·5.

The cumbersome weight of large apparatus leads to loss of opportunity. The difficulty and slowness of getting into action with the camera often leads to the picture not being "taken," whereas the man with portable apparatus has wider scope and creates opportunities for himself. The quarter-plate camera, either the field type or the folding hand camera type, and preferably all metal, is the ideal principal camera. It lends itself to universal work and can conveniently be fitted with supplementary lenses for different purposes. A type that may be recommended as forming a useful outfit for field work is a quarter-plate tropical model brass-bound teak camera, portable, strong and rigid. Rigidity of front is a most essential quality where long-focus lenses are used. A wooden camera should always be brass bound. The most modern cameras are of metal (aluminium of course is to be avoided). Messrs. Sinclair of the Haymarket have recently introduced the use of the airship metal duralumin for camera construction. It gives almost the rigidity and strength of steel, together with the lightness of aluminium but none of the disadvantages of that metal.

The rigid tripod is particularly important for a camera used for telephotography and also for any ordinary camera used in a windy climate. A quarter-plate camera really needs a broad-topped whole-plate camera tripod for satisfactory results. Increased rigidity may be obtained, if desired, by supporting the front of the camera by a second tripod. Another simple and effective device is to attach a cord to the tripod top and have an ordinary riding stirrup at the other end hanging just clear of the ground. The foot can press down on the stirrup, and so lock the tripod and eliminate vibration while the exposure is being made.

Tripods may usefully be fitted with an azimuth circle and compass for recording the bearing from the point at which a landscape photograph was taken. This, with a record of the focal length of the lens used, will

assist considerably in interpreting photographs and in illustrating maps. Azimuth circles are not regularly made for tripods of cameras, but can easily be made to order.

The lens of the camera illustrated is a convertible anastigmatic of 5 in. combined focus working at F/8 with two single components of 11 and 7 inches, which are fully corrected anastigmatic lenses themselves. There is thus a choice of three focal lengths, a most important consideration in landscape composition. A between-lens shutter is fitted; and screw ring adapters are provided for attaching orthochromatic filters to the lenses. The use of these filters is strongly recommended in landscape work for the correct rendering of skies and clouds by filtering out the excessive ultra-violet light and allowing skies and clouds to photograph in harmony with the rest of the landscape. Usually a filter of the intensity of a Wratten K. 1 with a medium or slow plate will accomplish this object with slow development; but a K. 2 filter with an orthochromatic plate may also be used if the improved rendering of greens and yellows in foliage is required. A K. 3 filter with a panchromatic plate gives complete colour correction, making the gradation in monochrome correspond to the scale of luminosity of colours as they appear to the eye, which luminosities of course are different from those which the ordinary plate, sensitive only to blue and ultra-violet light, will record. In selecting light filters it is important to stipulate that they be of the best optical flat glass, so that they will not interfere with the critical definition of the lens. It should be noted that a filter used in front of the lens does not affect the focus of the lens, but used behind it will alter the focal length. In this latter case focussing should be done with the filter in place or else with a dummy clear glass filter. Very good results in cloud and mountain photography can be obtained by photographing on a panchromatic plate with a red filter, which darkens the blue sky and emphasizes the white clouds. The thin, fleeting, feathery clouds, often so beautiful in effect in mountain scenery, can be caught on the plate by this means, whereas they are difficult to secure on an ordinary plate.

In landscape work it is advisable to use a relatively long-focus lens (say a 7-inch lens on a quarter-plate as a minimum), and always use a large lens aperture in order to reduce the depth of definition, differentiate between the planes of focus, and so introduce atmosphere and perspective into the picture.

Supplementary lenses for the camera should be mounted with their shutters on spare lens panels and carried in a spare compartment of the carrying case. Thus the provision of a wide-angle anastigmatic lens, together with a dropping base board and short-extension focussing rack on the camera front, will allow the same camera to be used also for wide-angle work—architecture, interiors, forest scenes, precipitous valley and mountain scenery, and panoramas. A telephoto lens, which may be either a complete lens in itself or else a tele-negative for use with

the positive lens of the camera, will enable telephotography to be undertaken also with the same apparatus.

Orthochromatic filters are absolutely necessary in telephotography to reduce or eliminate the excessive ultra-violet light reflected by all distant objects. As much as a K. 3 or G. filter may be needed for the telephotography of distant snow mountains.

Lastly, another useful supplementary lens to carry will be a large-aperture telephoto, such as an F/5·6 11-inch lens on a quarter-plate for portraiture and figure studies.

Colour Photography.

Colour photography should be confined to the representation of clearly coloured objects, such as architecture, paintings, costumes, flowers. Landscape is always rendered better in monochrome, which may however be toned.

The Lumière Autochrome process of natural-colour photography is eminently suited to travellers' requirements. The process is simple, and no special apparatus is needed beyond a light filter for the lens, and dark slides permitting of the plate being inserted glass side to lens. The autochrome process is really an adaptation of the three-colour process, the three colour screens being embodied in the plate itself by introducing a layer of fine coloured starch grains between the glass support and the sensitive emulsion. The plate being exposed with its back or glass side towards the lens, a colour-record negative is produced in the panchromatic emulsion. This negative after development is reversed into a positive by treatment with a bath of potassium permanganate and sulphuric acid, whereupon the colour photograph is produced by viewing the positive image through the transparency of the three-colour screen behind.

Autochromes make good lantern slides; but care must be taken to get them thin and nicely transparent, otherwise they may come out too dense for effective projection in a lantern. Autochromes may be printed now on paper, but the methods are difficult. The autochrome plates keep well if packed in sealed tins and developed shortly after being exposed.

The three-colour process of colour photography needs a repeating back and tricolour filters. The operations in the field are simple, being confined to the production of the three-colour record negatives, although the subsequent production of the finished colour slide is considerably more complicated and difficult than the Lumière process.

Instantaneous Photography.

At one time the reflex type of camera was predominant for instantaneous photography, but the reflex is bulky and heavy, being almost a one man's load in itself, so with the introduction of modern high precision anastigmatic lenses the day of the reflex has gone. Although focussing is

quick with the reflex, it is obvious that it would be an additional advantage still if no focussing whatever were required. This can now be done, thanks to the anastigmatic lens, by so far reducing the size of the plate and consequent focal length of the lens, that the depth of definition (resulting from the shortness of focal length of the lens) obviates the necessity of focussing. So now the small vest-pocket size fixed-focus camera, being the acme of portability and simplicity, displaces the reflex, and is pre-eminently the best camera for instantaneous work.

Another excellent type is the 45 by 107 mm. stereoscopic fixed-focus camera using glass plates or films. The separate images of the pair can be used for enlargement, or the pair can be used together for stereoscopic viewing. Tripods for these cameras can be conveniently provided by attaching them by means of special clips to walking-sticks or ice axes.

Panoramic Photography.

The panorama is really the best way of photographing landscapes. The panorama may be produced by using a wide-angle lens on an ordinary plate, which will give an angle of view up to about 90°, or by photographing with a special panorama camera. Some of these work on the swinging lens principle with the film on the segment of a circle, including a view angle of 120°, and others have a fixed lens with revolving tripod turn-table. The latter are capable of photographing a complete panorama of 360°.

Kinematography.

Motion photography involves considerable expense and much time and patience. Each picture has to be designed as part of a connected whole, planned and thought out much as a narrative which is to be recorded in writing or print. The process of developing the film in the field requires much time and trouble. For these reasons kinematography should form part of a traveller's photographic programme only if he has the time and opportunity to apply himself to the labour involved. If he can do this the value of motion photographs will certainly repay him.

In selecting a kinema-camera portability and strength combined with high-class workmanship in the mechanism of the camera and the provision of the highest quality anastigmatic lenses are the principal considerations from the traveller's point of view. They seem to me to be combined in the Newman Sinclair, a camera characterized by its portability and excellent workmanship. The following are desiderata in the selection of a camera: (1) A single-claw mechanism for moving the film as opposed to double-claw. The single-claw gives greater accuracy in register, and consequently steadier pictures, particularly when film shrinks in length in adverse climates. (2) Portability (in size and weight): complete outfit with tripod not to exceed about 40 lbs. in weight.

(3) Simplicity—film easily threaded and all working parts visible. (4) Good film capacity—400 feet. (5) Good and quick direct-vision view-finder. (6) Counter and speed indicator, fitted at the back of the camera so as to be visible while operating. (7) Lenses—fitted or quickly interchangeable mounts—stops and focussing scales automatically controlled, if possible; otherwise controlled from back of camera whilst operating. (8) Open-mouthed film boxes to obviate electrical friction markings.

Developing should be done in the field so as to check the work step by step as it is produced, and to get good-quality negatives by avoiding delay in development. Consequently the provision of a portable dark room outfit will be of importance. Practical experience has shown that flat frames holding 50 feet in vertical galvanized iron or wooden tanks give the best method of developing. They are quicker than pin frames or flat frames in flat dishes, and they obviate the oxidization of the developer consequent on using open dishes. Washing may be done in a large folding canvas bath. A folding winding frame and efficient dark-room illumination with a swivel lamp will be needed for handling the film in the dark.

Methods

Plates and Exposure.

Knowledge of the chemical qualities of plates and of the chemical action of light and developer on the sensitive emulsion emphasizes the advantages of using slow or medium speed plates, instead of being carried away by makers' advertisements of the excessively rapid plates they manufacture. The slow plate has a thickly coated rich emulsion, giving a splendid range of graduation in the image, and also allowing a considerable latitude in exposure. It has better keeping qualities in bad climates, and is far easier to manipulate in the dark room. Backed plates are an advantage (but not a necessity) where excessive contrasts exist, as in snow photography; but they are more troublesome in development. In conjunction with the use of slow, long-latitude plates, a full exposure with slow development in diluted developer should be given. Many errors in exposure come from relying on guesswork instead of measuring the intensity of the light with an actinometer and calculating exposure by means of that instrument, and from not allowing for variations of exposure according to "subject." A brief table of such variations is as under. The standard rule must be to expose for the nearest and darkest part of the subject.

Heavy trees and shadows in foreground.	Increase to twice normal exposure.
No foreground—only middle distance	Decrease to half normal exposure.
Open sea, snow, a sandy foreground	Decrease to quarter or more of normal exposure.

The merits of plates *versus* films make an old controversy. Better definition was usually obtained on plates owing to their flatness and better emulsion. But the plate is heavy and fragile compared with the film. The film has been so much improved of late, that it now claims to have an emulsion as good as the plate, but it has the disadvantage still that only fast-speed film is as yet made, and the advantages of slow-speed emulsion have already been described. Film has another advantage of being relatively free from halation. Only flat film is of service, of course, as roll film will prevent the use of the focussing screen, and focussing for composition in landscape photography. Generally speaking, one might say that plates are preferable for landscape work, but film for instantaneous photography in small cameras. If a good slow film were produced, then film would probably be preferable all round (except, of course, for colour photography).

Development.

Development should always be carried out in the field, within about fourteen days of exposure and within six days in tropical countries. Success is half assured by using a good slow, long-latitude plate and adopting correct methods in exposure; the other half of success is assured by correct methods of development. The outstanding principle is "Exposure governs density; development governs contrasts." This principle, proved by Hurter and Driffield's experiments and investigations, is not generally understood; and people consequently fall into the mistake of attempting to control density by prolonging or shortening development. But development cannot control density; only exposure can do so. Development governs only the contrasts, which are built up in direct ratio to the time the developer is allowed to act on the image. This principle being recognized, development merely becomes a mechanical question of time depending upon three factors: the brand of plate used; the strength of the developer; the temperature of the developer.

Variations caused by the first two may be eliminated by standardizing the plates used and using the same developer always at the same strength. Then time of development will vary only with the temperature and the degree of contrasts required in the negative. A time-table can be made. This method has the advantage of being scientifically correct and also being simple, convenient, and quick. The negative need not be watched during development, and a number of plates can be developed together in a tank. The racks hold twelve plates (six pairs back to back with half inch clear space between pairs). The rack fits into the metal tank holding 48 ounces of developer, the other tank being used for fixing. The racks and tank are of nickel-plated brass.

To summarize, the advantages of this time and tank method of development compared with the old method of tentative development in an open dish are:

(1) Speed and simplicity of method in the field; (2) It is based on scientifically correct principles, whereas tentative method is not; (3) It ensures uniformity of resultant negatives; (4) There is no damage to plates by fingering in the dark; (3) There is minimum risk of fogging plates; (6) There is no oxidization of the developer.

DEVELOPMENT SPEED TABLE

Plates: Imperial Fine Grain ordinary.
Developer: Tabloid Rytol at half normal strength.

Temperature. Degrees Fahr.	*Time of development (minutes).* Soft contrasts.	Normal contrasts.
45°	8	10
50°	7	9
55°	6	7½
60°	5½	6½
65°	4½	5½
70°	3½	4½

The above is an example of a development time-table worked out for an Imperial Fine Grain ordinary plate with Rytol developer of half normal strength. It will be seen that the two columns of "times" are provided according to whether soft or medium contrasts are needed in the negative. Snow scenes, and landscapes, and all negatives for enlarging, will need soft contrasts, whereas normal subjects such as houses, street scenes, etc., will require normal contrasts. The class of negative required is thus determined before development, and time of development regulated according to that choice.

The method of making such development tables for any particular plate and developer desired is as follows. Determine by trial the correct exposure for the plates. Then expose half a dozen plates on the same subject. Make a test of the time of appearance of the image (Watkins Factorial Method)—*i.e.* the exact time for the first sign of appearance of the image from the first pouring on of the developer—over a varied range of temperatures of the developer. Then plot these respective times and temperatures in the form of a graph, and from the graph read off the times of appearance of the image for all temperatures at 2° differences from, say, 45° to 70° F. The completed time-table can then be made by multiplying these times of appearance by the Watkins factor for the contrasts required. The construction of these tables for particular plates and developers that individuals may select will amply repay the trouble by rendering development efficient and simple.

All chemicals, particularly developers, should be in tabloid form in sealed bottles. Being thus in a compressed anhydrous state they keep well; and also being exact and uniform in composition they give the necessary quantitative precision in compounding solutions.

Water for solutions must be perfectly pure and free from dissolved mineral salts and dissolved air. It pays to carry a small still and distil and boil all water used.

Washing can be conveniently done in folding canvas baths, leading the water in through a canvas or rubber pipe and filtering grit and suspended matter. Plates need 1½ hours in gentle running water for perfect washing.

Hardening by means of a bath of Formalin will be needed in hot countries. Plates can be developed in any temperature if hardened.

Developed negatives should be varnished to protect them from scratching and from damp, and packed away in envelopes.

Developing apparatus and chemicals should be packed for convenience in a special travelling case fitted with compartments so that everything has its allotted place and can be easily found and quickly used. The developing outfit should include a Wratten safelight dark-room lamp with acetylene generator (fitted also with electric lamp for use where electricity is available). The lamp is mounted on a swivel support clamped to the table, and can thus be turned to illuminate any part of the dark room or work table. Developing tanks, racks for the plates, thermometer, measure glasses, together with a strong folding camp table, canvas water-buckets, and a set of half a dozen blankets with rings sewn on ready for hanging up over doors and windows to convert any room into a dark room, complete the main items of the traveller's equipment.

A tentative list of what should be packed in the dark-room box is as follows:

7 by 5 Wratten safelight lamp with acetylene generator and safelights series 1, 2, 3, and spare ruby paper in case of breakage of safelights.

Nest of developing, fixing, and hardening tanks with plate racks for 48 plates.

2 film-developing clips.

2 thermometers.

Development speed tables.

Dark-room clock.

1 printing frame.

3 half-plate enamelled steel dishes.

1 packet of pins.

1 plate-dusting brush.

Drying racks to hold 48 plates.

Griffin's water still.

1 celluloid measure, 8 oz.

2 enamelled steel graduated jugs.

1 folding negative-drying box with muslin curtain.

Cotton wool.

Negative varnish.

A suggested list of camp equipment packed in separate canvas valise or yakdan is as follows:

Strong folding camp table.

2 large canvas water-buckets.

1 folding canvas bath for washing plates.

Camp stool.

Set of opaque blankets with rings sewn on to hang over doors and windows to convert any room into a dark room.

Some sheets of brown paper for similar purpose.

5 yards of rubber pipe for conducting washing water, with a filter to eliminate grit and sediment.

Canvas porous bags for cooling water.

2 pairs of mule yakdans for carrying chemicals and equipment.

2 waterproof canvas sheets for mule transport.

Before the paper the PRESIDENT said: I have much pleasure in introducing to you Captain Noel, who a few years ago, just before the war, made a very interesting exploration in the direction of Mount Everest. He has for many years made a special study of photography, and our collections include many examples of his skill.

Captain Noel then read the paper printed above, and a discussion followed.

Mr. JAMES A. SINCLAIR: I have had a good deal of experience in outfitting of scientific expeditions to various parts of the globe. I agree, with one or two exceptions, with what Captain Noel has said. I quite think that with the small camera, say quarter-plate, you can do better work than with the old types of half-plate and whole plate, because of the extraordinary definition you get with short-focus anastigmatic lenses. There is one point in which he went contrary to all the advice I always give with regard to plates, in recommending slow plates against rapid ones. I am an advocate of rapid plates. I want a plate fast enough to be able to go into Piccadilly Circus at night and take a snapshot without any trouble. What we want are plates with a long scale of gradation. Many slow plates are very short in gradation. If I am taking a photograph, I want to show all the details in the darkest part of the subject without losing the gradations in the high lights. If you have snow and pine trees, you want to get the gradation in the pine trees without losing the values of the snow. A great deal depends upon having a plate with a long scale of gradation, and upon the way it is developed. For subjects with violent contrasts a definite time in a normal developer is not entirely satisfactory. A better plan is to place the plate in a normal developer, and then when the image appears to transfer it to a dish of water; the pyro or other silver-reducing agent absorbed by the film soon completes its work and becomes exhausted in the high lights, but continues in action in the shadows, and a softer and more harmonious negative is the result.

Mr. WALTER SCUTT: One point has not been mentioned by either speaker which I think is of great importance, that is, that so far no makers have succeeded in making a very rapid plate with a fine grain. In many kinds of work, especially when the negative has to be enlarged, or of course in dealing with any very fine details, it is most necessary to have a very fine-grained plate. The rule I would give is this: use the slowest plate that will do the work in the time available, especially when rendering fine detail, or when you have to enlarge your negatives afterwards; but from my own experience, both in scientific and pictorial work, I can heartily endorse all that has been said as to taking advantage of the wonderful definition of the modern anastigmatic lens, using small apparatus, and afterwards enlarging from the negatives.

Mr. FRANK DEBENHAM: May I ask Captain Noel to tell us something about his experience as to finding the value of the light? I think that is the most important thing for the average traveller, who is not a photographer, and I should like to know whether Captain Noel recommends a photo-meter or an actinometer or some diagram method. I think it would be a great help to people using photography in the field to have his advice on the subject.

Mr. HINKS: In the course of a long discussion with Captain Noel on the paper he has given us with so much success, I have found that there are one or two points in which I do not exactly agree with him, and one is the question of the small *versus* the large camera. It is true that the modern small camera beats the old-fashioned large camera, but that does not mean there is no advantage in the large camera, because the action of the modern lenses is equally good in both, and it does seem to me you still do gain advantage by taking up a large camera for use when circumstances allow you. The perspective is better with the longer focus. I believe some of the pictures round the room this evening were taken on the Mount Everest Expedition with a $7\frac{1}{2} \times 5$ camera as high as 22,000 feet; they show that a large camera is not entirely cut out by the small one. It was a great feat taking up that heavy camera as far as 22,000 feet, and some of those results must gratify Dr. Wollaston. As to the sort of plates, I spent a good many years in my life doing astronomical photography, and I thoroughly agree the great bane of the rapid plates is the large grain, and one should use as slow a plate as possible. I am entirely on the side of Captain Noel and against Mr. Sinclair on the question of slow *versus* quick plates. On the question of the stereoscope I am a little doubtful whether if, as I understand, an instrument like this gives a base of about the same length as the distance apart of the human eyes, you really gain any advantage in landscape work. It is true you can stick up a guide in the immediate foreground, and get him in high relief, but it seems to me that the presence of something standing out distracts your eye from the most important part of the result, and has rather a cheap effect, that the landscape photographer would do well to avoid rather than to imitate. One of the advantages of the panoram Kodak instruments is that you can measure angles, at any rate roughly, from them, and you can execute triangulations and re-sections by measuring up panoram photographs with a foot rule. One word about the colour process. I was very glad Captain Noel declared it is no good for landscape work. There is only one process that will tackle landscape, and that is the Lippmann process, which is very complicated and difficult, and nobody but Lippmann himself and his wife ever succeeded in making it work. One has seen his marvellous results, and can only regret he died the other day, so that we are not likely to see any considerable expansion now of that singularly beautiful process. I do not think I have anything more to say except to hope that the value of Captain Noel's great experience of photography may be available in the selection of further apparatus for the Mount Everest Expedition next year.

Dr. J. W. EVANS: I should like to ask Captain Noel whether, if you are going to give us these small cameras with an object of enlarging very greatly afterwards, you do not have a lot of trouble in getting the very exact focussing which is required?

Captain NOEL: Focussing should always be done with a focussing magnifier, which may be clipped on with an elastic cord over the eye. What worries one most is the enlarged grain of the ground glass under the magnifier. With regard to fast plates *versus* slow, I think that if one had a fast plate with a fine grain and a long range of gradation it would be the ideal. The disadvantage of the fast plate is its short range of gradation and the coarseness of its grain. It is on that account that I do not like it myself. I recognize the value of a large camera for landscape photography. I think a large camera is very nice for composing your picture; but should you have many branches of work to undertake, including kinematography, it becomes necessary to minimize

the number of cameras carried and to curtail weight. On that account I advocated the quarter-plate camera ; but should one be interested only in landscape photography, then the 7 × 5 camera should certainly be used in addition to the quarter-plate. As regards devices for estimating correct exposure I have always found the actinometer type of exposure meter most useful. The actinometer actually measures the intensity of the light at each occasion. Tables of light values are unreliable in my opinion.

The PRESIDENT: I should like those present here to have a look at the photographs round the room, which are the best of the photographs taken on the Mount Everest Expedition. Many were taken with a 7½ × 5 inch camera. I think you will agree with me they are excellent results, especially those photographs of Makalu. What interested me particularly in Captain Noel's paper was his expression of views in regard to colour photography ; I was sorry to hear it is not possible to get good results by colour photography for landscape work, because we are particularly anxious to secure these beautiful colour effects to be found in the high mountains, which are exceedingly delicate and very hard to reproduce. But at any rate for flowers and other subjects in which there are very distinct colours, colour photography will be of great value. On this next year's expedition we shall have, I hope, the advantage of all the skilled advice which was so freely given on the present expedition, and we intend this time to send out a really experienced photographer—as experienced as Captain Noel himself, and with the same experience in the field—and we shall hope that next year we may perhaps have even better results than we have here at present. I am sure you will wish me on your behalf to thank Captain Noel most warmly for his valuable lecture.

JAN MAYEN ISLAND

J. M. Wordie

Read at the Meeting of the Society, 21 *November* 1921.

Historical.

COMPARED with other Arctic islands Jan Mayen is small in size and has no doubt suffered on that account ; on the other hand, the extinct volcano of Beerenberg, with the exception of certain nunataks in Greenland, is the highest mountain within the Arctic circle. The smallness of the island has probably deterred many an intending visitor, who has gone instead to the more distant and more ice-surrounded Spitsbergen. The mineral wealth of the latter, moreover, gives to it a status which the barren Jan Mayen can never acquire ; but at one time, during the period of Dutch whaling supremacy in the seventeenth century, these two islands were rivals in economic importance. To-day the situation is very different.

Jan Mayen has a reputation, in Britain at any rate, for being cloud-covered and hard to locate. This is probably an exaggeration, for the summit of Beerenberg is generally clear, and is a striking landmark visible from more than 100 miles away. The words "mist obscured" could with more fitness be applied to the early history of the island.

In the Icelandic "Landnámabók" it is written that "from Langanes on the north side of Iceland it is four doegr's sea to Svalbard [*i.e.* the cold coast] on the north in Hafsbotn." By "Hafsbotn" the early Scandinavians meant the end of the sea to the north of Norway and north-east of Greenland; in a similar way they speak to-day of "Ishavet." A doegr was twelve hours' sail. The chronicler therefore meant that "Svalbard" was forty-eight hours' sailing distance from the north of Iceland. As the distance from there to Jan Mayen is 288 and to Spitsbergen 840 nautical miles, there would seem to be little doubt that it is the former island that is meant. This is not the view held generally by Norwegian historians, and among them Dr. Nansen. Dr. Nansen, as I read him, puts forward only one serious objection to Svalbard being accepted as Jan Mayen, namely, that the term "cold coast" would only be applied to the coast of a larger country. It is surely fair, however, to suppose that Svalbard would, whatever its size, be the coldest coast known to the early Scandinavians: this might be Jan Mayen so long as Spitsbergen was undiscovered. A further argument against Spitsbergen being Svalbard is the absence of strong proof of walrus-hunting by the early Norsemen, as would certainly have occurred had Svalbard been Spitsbergen: the latter is a favourable field for walrus, Jan Mayen not at all. That Svalbard, despite the weak evidence, is still generally claimed as being Spitsbergen finds a ready explanation in the desire at present shown by Norway to establish an historical as well as a geographical claim to that group. A similar failing was once shown by Dutch and English writers in assessing the rival claims of their countrymen to priority of discovery in Spitsbergen and Jan Mayen in the beginning of the seventeenth century.

When in the fourteenth and fifteenth centuries Norway declined as a seafaring nation and the important Greenland colonies were neglected, the existence of the much less important Svalbard or Jan Mayen was soon forgotten. Its rediscovery dates from the seventeenth century, during the time when the English and Dutch were rivals on all the Arctic whaling grounds. Owing to this trade rivalry it is not always certain whether contemporary statements can be treated as reliable or whether some may not be forgeries. The discovery of a new field such as Jan Mayen might moreover be kept secret on economic grounds. In this country Hudson has generally been looked on as the discoverer, but in Holland Jan Jacobsz May has always been given the credit. The facts can speak for themselves.

Thomas Edge, in his "Briefe Discoverie of the Northerne Discoveries of Seas, Coasts and Countries etc.," printed in 'Purchas His Pilgrimes,' says:

> In the yeere 1608, the said fellowship set foorth a Ship called the Hope-well, whereof William Hudson was Master, to discover to the Pole, where it appeareth by his Journall, that hee came to the height of 81.

> degrees, where he gave Names to certayne places, upon the Continent of Greenland formerly discovered, which continue to this day, namely, Whale Bay, and Hackluit Headland, and being hindred with Ice, returned home without any further use made of the Countrey, and in ranging homewards hee discovered an Iland lying in 71. degrees, which hee named Hudsons Tutches.

The above relation by Thomas Edge is obviously incorrect. Hudson's Christian name is wrongly given, and the year in which he visited the north coast of Spitsbergen was 1607, not 1608. Moreover, Hudson himself has given an account of the voyage and makes absolutely no mention of Hudson's Tutches. It would have been hardly possible indeed for him to visit Jan Mayen on his way home from Bear Island to the Thames. It is true that Hudson on his way to "Hold with Hope" discovered a headland to which he has given the name Youngs Cape, and near it "a very high Mount like a round Castle" which he called Mount of Gods Mercie. Neither of these places can be absolutely identified, but they are certainly not on Jan Mayen and are probably somewhere on the coast of Greenland. There is no justification, therefore, for accepting Edge's narrative; it has never been substantiated. A possible explanation might be that the island had been discovered by Hull men, but its discovery kept secret: rumour might account for this garbled version by Thomas Edge.

The account of the Dutch discovery of the island is much more reliable. A document bearing the date 29 August 1615 is preserved in the Dutch Archives at the Hague. It is a request to the States General by the Noordsche Compagnie to have the discovery accepted as made in July 1614 by their two ships *De goude Cath* (the Golden Cat) and *Den Orangienboom* (the Orange-tree). Jan Jacobsz May was captain of one of these ships, Joris Carolus mate. The company had been forced to put forward this claim, as a ship captained by Jan Jansz Kerckhoff and owned by a rival company had also visited the island that same summer.

May's discovery is confirmed by the finding in recent years in the *Depôt des Cartes de la Marine* in Paris, of the original map drawn by Joris Carolus himself in the year 1614, and on which he calls the island after himself, "Mr. Joris Eylandt." This map has been reproduced in Dr. Wieder's 'Dutch Discovery and Mapping of Spitsbergen.' It also marks North-east Cape as "Jan Meys Hoeck" and Driftwood Bay as "Gouwenaers Bay." It is interesting to find that the mate's naming of the island after himself was soon replaced (Blaeu, 1623) by the more appropriate captain's name.

The first authentic English visit is that of Robert Fotherby in 1615. Believing the island was a new discovery, he called it Sir Thomas Smith's Island. His description given in Purchas is as follows:

> This Iland is about ten leagues in length, and stretcheth North-east and South-west: it is high Land, and at the North end of it there is a

> Mountayne of a wonderfull height and bignesse, all covered with Snow, which I called Mount Hackluyt; the base or foot of it on the East side is almost foure leagues long, it hath three such sides at the base lying out to the Sea, and from the fourth side doth the rest of the Iland extend it selfe towards the South-west, which is also, as it were, a place fortified with Castles and Bulwarkes, for on each side there bee three or foure high Rockes which stand out from the Land, appearing like Towres and Forts. It lyes in the parallel of 71. degrees, where the Needle varieth from the true Meridian Westwards eight degrees. The Land is generally so farre as I have seene, Rockie and very barren, and worse than the Land that I have seene in King James his New Land, under eightie degrees, for there is no grasse but mosse, and where I first landed upon low ground, all the stones were like unto a Smiths sinders both in colour and forme, the sand is generally mixed with a corne like Amber; the Beaches are abundantly stored with drift wood and many stones, like light Pumis, which will swimme on the water. I saw many traces of Foxes and the footing of Beares, but not any signe of Deere or other living creatures, and very small store of Fowle.

It is a duty to quote the above account in full: one is filled with admiration for the shrewd seaman who noted even the olivine crystals so common in the beach sand. Bears are no longer found on the island; otherwise the description holds good to-day and might well be quoted in the Admiralty Pilot. It seems a pity that Fotherby was forestalled by the Dutch the previous year: "Mount Hackluyt," however, has priority in name over Beerenberg. This is the same Fotherby who is quoted by Purchas as saying (before 1625), "the Dutch have beene a bane to this Trade and Discoverie: The Hull-men have done some bad service in this Action, for they were the first that carried the Dutch to the Tutches, as by Wivendens Oath and Journall appeares." This outburst of Fotherby's may perhaps give the clue to the early history of the island. At the time he wrote the words just quoted he must have known the whole history of the island, and it is important therefore to note that he chooses the name Tutches from among a host of others. May's discovery in 1614, however, still remains the earliest well-authenticated one. Of the other claimants, Hull whalers (possibly Thomas Marmaduke) are said to have discovered it in 1611 or 1612 and to have called it Trinity Island. Jean Vrolicq, the Biscayan, said he visited the island in 1612, and called it Isle de Richlieu. Other old names are Young's Foreland, Mauritius, and Pico.* The truth of these claims has still to be settled. Meantime it seems appropriate that the often-named island has finally settled down under the name of its first authentic discoverer.

* Sir Martin Conway, 'No Man's Land,' 1906. S. Muller Fz., 'Geschiedenis der Noordsche Compagnie,' 1874. M. Charles Rabot mentions a manuscript map in Bergen of date 1610 with the island inserted.

I am indebted to Dr. Wieder for the positive information concerning Jan Jacobsz May's voyage.

Whaling was begun by the Dutch in 1616. In 1618 there were as many as nineteen Dutch whalers at the island. Vats were built ashore where the blubber could be rendered down. In some places their foundations are still visible: a few thin bricks can be found or perhaps a small heap of coal. A Dutch painting dated 1639 and reproduced in the *Geographical Journal*, vol. 31 (1908), p. 645, shows one of these Dutch "cookeries" in full activity. The busy scene in that picture is in striking and amusing contrast with the desolate nature of the west coast nowadays. The fishing off the island was very rich by all accounts. The Dutch had pretty much their own way generally on Jan Mayen; but in August 1632 Jean Vrolicq descended on the unguarded stations and pillaged them. The Dutch therefore left a guard the next year (1633–4), but all of them died of scurvy. The journal and daily weather notes of the unfortunate party have been printed several times. Soon afterwards the fishery appears to have suddenly declined. When Zorgdrager visited the island in 1699 he found most of the equipment left as if the owners had expected to return.* Some bad ice years may have happened just then, and in the interval the whalers may have found better hunting-grounds.

The island must still have been visited frequently by whalers working the "vestis" in the eighteenth century and early part of the nineteenth. Nowadays sealers going to and from Denmark Straits and Scoresby Fiord occasionally put in for water or to take shelter.

One of the early captains has described the most interesting of the known events in the island's history, an eruption in 1732. It is quoted at length in a footnote in Johann Anderson's "Nachrichten von Island, Grönland, und der Strasse Davis," published at Hamburg in 1746.

Jacob Jacobsen Laab was the captain of a whaling ship lying becalmed 3 German miles south of Beerenberg when an explosive outburst took place *at the foot of the mountain*, with flames shooting out, followed by the formation of a dark cloud. The "fire" lasted one day, but nothing happened on the big mountain above. The black cloud lasted four days, perhaps longer, as a change of wind by then enabled the ship to proceed on her way: in so doing, however, her decks were covered when she was quite 15 German miles away with ashes, so that the sails became black. One has no hesitation in accepting this as a true statement; for an impostor could not have avoided making the eruption on the big mountain and introducing lava as well as ashes. It is a further confirmation that the three possible places for such an outburst are all near the foot of the mountain on the south side, namely Berna Crater, Egg Bluff, and a subsidiary crater beside Vogt (or, as it should be called, Esk) crater. I regard the latter as the likeliest locality, despite the hot steam still coming from Egg Bluff.

After J. J. Laab's record one is predisposed to accept the somewhat

* 'C. G. Zorgdragers Bloeyende Opkomst der Aloude en Hedendaagsche Groenlandische Visschery': door Abraham Moubach. 1720.

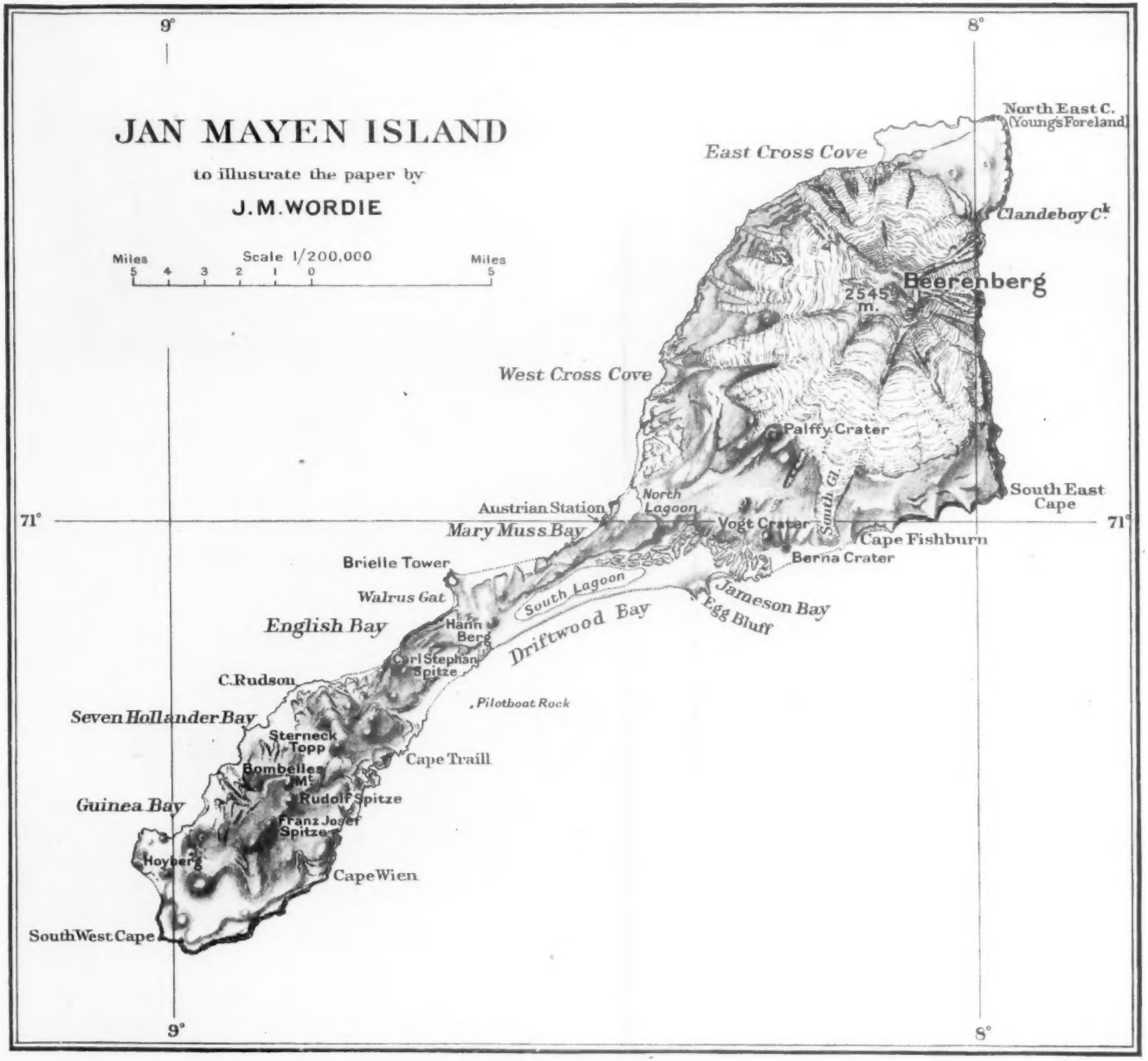
BEERENBERG AND SOUTH LAG

BERNA CRATER—AN ASH VOLCANO—ANI

AND SOUTH LAGOON

H VOLCANO—AND EGG BLUFF

Phot. J. L. Chaworth-Musters.


JAN MAYEN ISLAND
to illustrate the paper by
J.M.WORDIE
Miles 5 4 3 2 1 0 Scale 1/200,000 Miles 5
9°
8°
71°
North East C.
(Young's Foreland)
East Cross Cove
Clandeboy C.k
Beerenberg
2545 m.
West Cross Cove
Palffy Crater
South East Cape
South Gl.
North Lagoon
Austrian Station
Mary Muss Bay
Vogt Crater
Cape Fishburn
Berna Crater
Brielle Tower
Walrus Gat
South Lagoon
Jameson Bay
Egg Bluff
Driftwood Bay
English Bay
Hann Berg
Carl Stephan Spitze
C.Rudson
Pilotboat Rock
Seven Hollander Bay
Sterneck
Topp
Cape Traill
Bombelles Mt.
Guinea Bay
Rudolf Spitze
Franz Josef Spitze
Hoyberg
Cape Wien
South West Cape

tentative account by Scoresby of a possible eruption in 1818. Hot steam still rises in clouds from Egg Bluff at certain states of the atmosphere; but these would not satisfactorily account either for Scoresby's observation that the smoke was projected upwards about 4000 feet, or for the shining redness recorded the same year by a Hull skipper. Moreover, Scoresby fixes the spot as "about the north side of Egg Island, near Esk Mountain" —in the very place where I locate the ash eruption of 1732.

Scoresby himself had been ashore the previous year (1817) and visited one of the extinct craters. His description agrees well with the Vogt crater of the Austrian map: indeed, he had no time to go elsewhere; but unfortunately the Austrians following Mohn have misplaced Scoresby's name, Esk Crater. The correction will, it is hoped, be made on some future map. Scoresby's visit is detailed by him at some length, and is a record of extremely careful observation. He still leaves one in doubt, however, as to whether Egg Bluff was really an island at that time, or whether his Cape Brodrick is not Egg Bluff, and his Egg or Bird Island the rock now much reduced and called the Calf. Scoresby's map shows no South Lagoon, and the sea is represented as reaching to a feature which is obviously the "Saule." The South Lagoon was probably dry that year, as it was in 1911, so Mr. de Gisbert tells me.

The next sketch-map of the island is by Dr. Berna and Carl Vogt in 1861. In this delineation Egg Bluff is certainly not an island, and the South Lagoon appears the same as it is to-day. These facts are confirmed by some charming tinted drawings. The absence of change in the sixty years since Berna's visit makes it probable that Egg Bluff forty years earlier was pretty much as it is to-day. Vogt and Berna were ashore at the same place as Scoresby and state they climbed the same crater (Esk), now erroneously called the Vogt Crater. They also visited the interesting little ash crater since called Berna Crater. The Swede Quannersted's visit was made in 1864, but unfortunately no drawings were made to supplement Vogt's.

In 1856 the island was visited by Lord Dufferin. His description is very general, however, and his view of the mountain somewhat distorted. It compares ill with Vogt's accurate and pleasing drawings and no less lucid account. Yet "Letters from High Latitudes" has done much to make Jan Mayen familiar in this country. A similar short visit was paid to the island in 1877 by Prof. Mohn on the *Voringen*. He was only ashore once, and was therefore not justified in altering the name of Esk Crater, which he did not visit: his outline of the coast, however, (*Peterm. Mitt.* 1878) took some days to complete, and was a distinct advance on Scoresby's.

The chart at present in use is that made by the Austrian wintering party in 1882–83. With abundant time at their disposal, they succeeded in producing a map which in those days was the best map of any polar country. We found it satisfactory in almost every respect. Their main

work was magnetic and meteorological in connection with other circumpolar stations, but they also found time to make some preliminary natural history collections. Theirs is the standard publication on the island.*

Since that date the island had never been visited for more than one or two days at a time. J. C. Wells (1872), Rabot (1892), Nathorst (1899), Otto Nordenskjöld (1900), the Duke of Orleans (1909), Charcot (1902, 1912, and 1913), the Duchess of Bedford (1911), and others, all made short and hurried visits, and have generally written accounts supplemented by useful photographs.

The 1921 Expedition.

The history of the island may perhaps have given the impression that its usefulness ceased with the collapse of the whaling industry in those parts. This is no longer the case; though lacking the mineral wealth of its great rival, Spitsbergen, Jan Mayen may yet prove useful in another field. A weather station equipped with wireless was established on the island last summer, and is likely to be permanent. As Mr. Chaworth-Musters' party obtained passages on the two small ships carrying the material of the station, he and his party had every opportunity at first hand of realizing the importance of this new venture.

Mr. Musters formed the idea of visiting the island early in January 1921, and was considering chartering a small vessel. In March he heard, however, of Engineer Ekerold's plan to establish a wireless station: co-operation was at once suggested, and a satisfactory arrangement soon reached. The party to whom Engineer Ekerold gave passages consisted of J. L. Chaworth-Musters as botanist, W. S. Bristowe and T. C. Lethbridge as naturalists, and the writer as geologist: Richmond Brown undertook the duties of "campman." With one exception we were all members of Cambridge University.

The objects of the 1921 expedition were to climb Beerenberg, often reported as being a still active volcano, and to make natural history collections supplementary to the preliminary ones made in 1882–1883 by the Austrian party. Whilst waiting at Bergen for Ekerold to complete his cargo we were met by Prof. Mercanton of Lausanne, who had long wanted to climb the mountain, and had come hoping to be able to join our party. We were thus unexpectedly reinforced by an experienced climber, who was also prepared to undertake glaciological studies in a unique field.

Inevitable but somewhat exasperating delays prevented the expedition from leaving Norway till August 1. Stiff but generally favourable winds ultimately brought the two ships (*Isfuglen*, 54 tons, and *Polarfront*, 24 tons) to Jan Mayen in five and a half days. The number of possible sites for the wireless station was limited, and Ekerold soon made his selection.

* One serious error on the Austrian map is the placing of Baren Gat south instead of north of Cape Traill.

Though not the most agreeable part of the island nor a good camp site, it nevertheless made a good central base; the next day saw our tents pitched at Jameson Bay, not far from where the wireless plant has since been erected.

The work of exploring the island was begun forthwith. We had already lost the first half of the short Arctic summer season; it was much too late to think of studying the nesting habits of the birds, and it was almost too late even to gather plants in the flowering state. Musters and Bristowe must therefore start collecting at once. They made a few short trips round the base, and then removed their quarters to a small tent 8 miles farther down the coast at the far end of the South Lagoon. From here they visited among other places Seven Hollander Bay, where a cross now stands in memory of the seven Dutchmen who wintered here in 1633, and died of scurvy in April or May the next year. Musters very soon began to find plants not previously recorded on the island. Since returning he has completed his identifications, and finds that of forty-three flowering plants five are new to the Jan Mayen flora. Whilst Musters was botanizing, Bristowe sought out and collected the insect life, more particularly spiders, the family on which he had been specializing.

So late was the date of our arrival that the snow was melted practically everywhere below 2000 feet above sea-level. The geological work could have been commenced straight away. On the other hand, the sun was already below the horizon at midnight, and it was essential to undertake the ascent of Beerenberg at once.

On August 9 the site of an advance camp was selected on the uppermost of the frontal moraines, 2770 feet above sea-level, and most of the necessary gear was taken up that day. The way thither led up a wide dry valley, between the so-called Esk and Vogt craters of the Austrian map. We always spoke of this as Ekerold Valley, to mark our appreciation of the latter's achievement in establishing a wireless station in this remote region. The valley is wide, but practically barren of all vegetation, owing probably to the scarcity of water, any precipitation being soon drained away through the porous volcanic sand. In normal years there may be more running water; indeed, the accounts of the cloud-covered nature of the island would seem to demand it. Last summer, however, very little rain fell during the month of August. Occasionally the hills, particularly at the south end of the island, were clouded over, but never for an extended period. The lower part of Ekerold Valley was found to be strewn with volcanic bombs of every conceivable shape; these came apparently from a small vent on the west side of Vogt (*i.e.* Scoresby's Esk) Crater, and it is here that I imagine the eruptions of 1732 and 1818 took place. Ekerold Valley is filled farther up by viscous lava; and still higher, about 2000 feet altitude, the stream cuts through an old and much-eroded crater. Quitting the valley at its top end we began to cross a series of frontal

moraines, and in so doing passed above and about 2 miles to the east of Palffy Crater, the small cinder-vent visited and named by the Austrians. The tent was pitched on the highest of the frontal moraines.

The climbing party—Mercanton, Lethbridge, and myself—went up to spend the night at the tent on August 10. Some rain fell early next morning and considerably delayed the start, so that it was nearly 11 a.m. before we finally commenced the ascent. For nearly 3000 feet we toiled up a gentle uncrevassed slope to a prominent nunatak whose height by aneroid was about 5600 feet above sea-level. The grade up to this point cannot have been much more than 8° (or 1 in 7). The snow-covered ice-slope which we had been traversing had all the appearance of an ice-carapace, such as the Hardanger Jökul. This may be so, and may point to the area being the region of most precipitation. On the other hand, Vesuvius shows a similar area of gentle inclination below the steeper final portion; and so also does Mt. Erebus. This conformation seems, therefore, most simply and probably explained as a result of the thinning out of lava-flows away from their source.

At the nunatak where we were now resting it was something of a surprise to find a small cairn, and we naturally thought this was the highest point reached by the Austrians in 1882 on the only other known attempt made to climb the mountain. It appears, however, to have been merely a mark used by them in the course of their survey; for the Austrian account points to their having tried to ascend by the buttress north of our route. From where we stood on "Austrian Nunatak" we at once realized that a successful ascent was likely. A prominent buttress juts south-west from a subsidiary top about 150 yards south of the summit proper: we might have gained that buttress and followed it to the top by a snow ridge of fairly easy aspect: on the other hand the ridge might be iced, and in any case would be more exposed to the wind than the depression on its southern side. The latter route was that finally selected.

I had asked Mercanton to be leader some time previously: the climb proper now commenced in the order: Mercanton, Lethbridge, Wordie. The way at first led through a moderately crevassed area, but at this height above the snow-line the snow bridges could be relied on as thoroughly sound. No real difficulty was experienced, therefore, until at 7200 feet a broad crevasse had to be jumped—one of those awkward uphill jumps in snow so soft as to give the very poorest of take-offs. About 400 feet higher the bergschrund was reached, and here some delay occurred, until Mercanton finally won across by clever step-cutting up a short vertical ice-wall. A climb up 150 feet of steep snow then took us to the ridge, which was but a part of the rim of the great ice-filled crater which gives the mountain its exceptional character. We estimated the diameter of the crater to be half a mile, and its depth 500 to 800 feet. At its northern side it has been breached by one of the later eruptions, and through the gap thus formed the Weyprecht Glacier escapes in a series of wonderful

EGG BLUFF, JAMESON BAY

BEERENBERG FROM EKEROLD WIRELESS STATION

Phot. J. L. Chaworth-Musters.

BOMBELLES MOUNTAIN

LAVA CRATER NEAR ENGLISH BAY

Phot. W. S. Bristowe.

ice-falls down to the coast 7500 feet below. The highest point of the mountain, where we were soon to stand, forms the western pillar of this gateway. The maze of crevasses down in the crater bowl, the almost unbroken bergschrund which ringed it round, and the very suddenness with which we came upon it made a thrilling impression at the time. After a short halt on the ridge, we proceeded to the summit along an interesting snow arête about 300 yards in length.

We made a stay of nearly two hours at the highest point, remaining longer than was necessary in the hope that it might clear sufficiently to allow of first-class photographs being secured. Those that we took by the light of a mist-obscured sun hardly do justice to the scene. I had been making aneroid readings whenever halts were made. These were compared later with a barograph record at sea-level, and when finally corrected give Beerenberg a height of 8090 feet. The Austrian figure obtained by theodolite measurement was 8350 feet. I am inclined to trust my own figure despite the many objections that can be urged against an aneroid, because I have since found that the Austrians worked with a very narrow triangle, and definitely state that their figures are open to question.

It had taken eight hours to reach the summit, but the return to the advance camp was made in less than half that time. The greater part of this difference is accounted for by the reconnoitring which was necessary on the outward journey, the remainder to the first-rate condition in which we found the snow on our return. In high latitudes the snow, as far as my experience goes, can always be relied on; iced slopes are only found close up to rocks. We should therefore have been quite safe in climbing by way of the south-west buttress: it probably offers the quickest if not the most interesting way to the summit.

We left most of the climbing equipment at the Advance Camp before returning to the Base Camp. We did so, fully expecting to be able to make a second ascent. The attempt was too long delayed, however, and when we did return to the high camp on August 29 it was to find the tent blown down and filled with ice. The climb might still have been made, but during the night a blizzard got up which effectively stopped progress, and we were forced to return. It is certainly desirable that the mountain should be climbed a second time and a complete traverse made of the crater rim.

Soon after returning from Beerenberg Lethbridge and the writer relieved Bristowe and Musters at the South Camp. We now proved at first hand that this is both the wetter and cloudier end of the island. This did not prevent us, however, from making a detailed survey of most of the ground, and on one occasion we had the good fortune to rise through the clouds and remain above them on the hilltops throughout the day—a day made memorable by the wonderful aspect of Beerenberg

20 miles away to the north-east. Without undue exertion we carried out our programme at the south end and climbed most of the hills there. When it was finished we joined Mercanton at his glaciological studies by the South Glacier. The only parts of the island unvisited by some member or other of the expedition before we left on September 3 were the coast between Guinea Bay and Cape Wien, and the north-west, north, and eastern sides of Beerenberg; Mercanton, however, sailed round the latter region and secured photographs which at least give us a full knowledge of the lie of the glaciers in that part. Glaciers, it may be stated, are confined to Beerenberg.

The part which the Cambridge party got to know best is of course the region within a 5-mile radius of Jameson Bay. This is the more exposed side of the island: no matter what the weather may be, there is always a swell running in from the open sea. It appears quite possible that changes have taken place in historic times on the coast-line between Cape Traill and Cape Fishburn. The doubtful accuracy of the detail of the older sketch-maps, however, prevents any great reliance being placed on comparisons with past data.

In this region the leading feature is Egg Bluff itself, corresponding either to Scoresby's Cape Brodrick or to his Egg or Bird Island. It is a fragment of an ash crater of considerable size, but despite its being the only place where hot steam now issues from cracks, it is not on that account the very youngest volcanic episode. It is probably of much the same date as Beerenberg, and though now considerably eroded is quite sufficiently resistant to hold its own more or less against the attacks from the sea. On Vogt's drawings of sixty years ago it has the same shape and appearance as it has to-day. Forty years previous to Vogt's visit, however, Scoresby speaks of an island here—Bird Island lying off Cape Brodrick. Egg Bluff is probably Cape Brodrick; and Bird or Egg Island is probably represented to-day by the Calf; on the latter, though it is much reduced in size now compared with what it was in Scoresby's time, birds still nest in some number. I think this is a more likely explanation than that Egg Bluff was Bird Island itself, and is now joined to the mainland by the formation of a wide beach: the latter theory would seem to demand a much longer time-interval.

Stretching south from Egg Bluff to Cape Traill is an 8-mile-long beach, half a mile in breadth and thickly strewn with driftwood. South Lagoon is merely a shallow depression on its surface, and may at times dry up altogether. In the other direction from Egg Bluff there is a short sandy beach, then some cliffs, and then a mile-long beach with an intermittent lagoon similar to South Lagoon; then come the moraines of the South Glacier, and finally Cape Fishburn. The coast between Cape Traill and Cape Fishburn is, geologically speaking, of recent origin. It owes its beginnings to two fairly young lava-flows which had their source not far from Vogt Crater. These spread over a wide area, and together

with Egg Bluff Crater, formed about the same time, must have been an anomalous feature in the coast-line, which the sea has now brought into equilibrium by the formation of the long sand beaches. These considerable beach flats now compensate in some measure for the destruction of the great volcano on the site of the South Lagoon. I consider their formation took place long before Scoresby's visit.

The geological interest of the island mainly turns on the question of its age. We sought to determine the date at which the island was first formed, and if it was long since Beerenberg ceased to be an active volcano; on neither of these questions can one make a final statement. Partial answers, however, are furnished by the south end to the first question and by the north end to the second.

Near Franz Josef Spitze and Rudolf Spitze are found trachytes, no longer fresh as would be expected in the case of a recent eruption, but considerably decayed and perished. The mountains are carved into forms which bear slight relation to the structure, and are on the whole moderately subdued. Associated with the trachytes, and presumably post-dating them, is a conglomerate with sand-polished pebbles. Here was a chance to hunt for possible plant beds, but our efforts were fruitless. The sand-polished pebbles in any case indicated conditions inimicable to plant-life, perhaps owing to the abundance of volcanic sand lying at the mercy of the uncontrolled Arctic winds—conditions quite comparable to those prevailing to-day. The absence of any glacial deposits interbedded with the lavas, or of mountain features due to glaciation, is significant, and makes one think the island is very recent indeed. It would have been preferable of course to have been able to assign a definite date to these earliest eruptions, Tertiary or Quaternary as the case may be, but at any rate it is satisfactory to know that this end of the island is so much older relatively than Beerenberg. The presence of trachytes in the early stages of a volcanic period is in keeping with what is found in other parts of the world. The conglomerate is the proof of a pause in volcanicity, and the physiography of the southern mountain group points to a still longer pause following the formation of that conglomerate.

The base from which these early events can best be studied is Seven Hollander Bay. Between that place and the foot of Beerenberg the island is now at its narrowest, averaging less than 2 miles in breadth for a distance of about 8 miles. This however was not always the case, as is proved by the record of events found in the neighbourhood of the "Saule," the fantastic pillar rock on the edge of the South Lagoon. We studied this part from the base camp at Jameson Bay, but a more convenient centre would be Walrus Gat. The South Lagoon was found to be the site of a large crater, of which only the one side now remains and forms the imposing 800-feet-high rock walls along the north-west side of the lagoon. The lower part of the cliff consists of volcanic ashes and

lava-flows, the upper part mainly of lava-flows, into which occasional basalt sills have been intruded. Standing out in front of the rock wall is the high pillar of coarse agglomerate known as the "Saule"; its coarseness indicates that we are here standing very close to the centre of the crater. The sea, however, has removed the greater part of this old volcano, which in size may well have rivalled Beerenberg itself.

Beerenberg, though not the latest, is certainly among the last events in the volcanic episode. The focus of maximum activity had apparently shifted northwestwards step by step. This is a point that should not be stressed too much, however, in view of the following facts. Among the volcanic ashes forming Egg Bluff, for instance, are blocks of trachyte, rhyolite, and conglomerate, showing that in the north part of the island a similar set of events took place to what went on in the south. Secondly, at the stage which saw the formation of Beerenberg and its parasitic craters there was a corresponding outburst of activity at the south end, forming a few short-lived vents, whose issuing lava-flows dammed some of the main valleys, with consequent formation of temporary lakes. These latest lavas are all of the same type—olivine basalt with large well-formed crystals of augite and olivine. Tuffs may have played a part early in the history of Beerenberg—they form some picturesque cliffs round its periphery—but on the crater itself there is nothing but basalt lava. The parasitic cones, however, are not exclusively lava centres: three of them, Berna Crater, Egg Bluff, and an opening on the west side of Vogt (Scoresby's Esk) Crater are of fragmental origin. Egg Bluff is now much eroded by the sea, but though steam still issues from some cracks on its summit, it is not, I think, the very last scene of an eruption. That probably was beside the Vogt Crater—a conclusion we arrived at on the island, and which is now confirmed by reading Scoresby's account in 1818 and Laab's description of the eruption of 1732. These two events would afford a ready explanation for the large number of bombs found in Ekerold Valley on the west side of Vogt Crater.

Though unable to give a date for the commencement of volcanicity beyond surmising that it is Quaternary, one can at least date the final phases. A subsidiary ash vent was active a century ago. Lava eruptions, however, are not recorded, and probably ceased previous to the Dutch discovery in 1614. Since the island was first found, it has shown no more than waning efforts—an ash eruption, some earthquake shocks, and emission of hot steam from cracks. Beerenberg has certainly never been active in historic times.

On the somewhat unfertile soil produced from partially decomposed lava a scanty vegetation has now established itself. The prevalent strong winds and the large amount of loose sand do not give the plants much chance to flourish, however. This is certainly so on the south-east coast. The north-west side is slightly more fertile. Despite the disappointing

nature of the field Musters succeeded in getting results of value. So did Bristowe, especially with the insects. Seventy per cent. of his specimens are new records for the island. The bird-life, on the other hand, proved disappointing; like Robert Fotherby in 1615, we could well say that there was "very small store of Fowle."

In the way of economic minerals the island, so far as we have investigated it, has nothing to offer. There is a possibility, however, that the abundant driftwood, cast up by the sea to atone for the poverty of the island, may have a commercial value. Individual pieces of timber are certainly good, but, in the present writer's opinion, to gather it in bulk and ship it to Iceland would hardly be a paying proposition. Besides driftwood there are also found on the beaches numerous glass floats used by Norwegian fishermen to buoy their nets, copper floats of about 8 inches diameter used in a similar way for submarine nets, and the wrecks of at least three ships. All this jetsam has come by one route—north to Spitsbergen, westwards towards Greenland, and then south again on the skirts of the Greenland current—the counter-clockwise motion of the Norwegian sea.

The island therefore is unremunerative commercially. Norwegians, however, have realized its importance in another field. Their country is peculiarly dependent on coastwise shipping, and in the past this has suffered very heavily from unexpected northerly and north-westerly gales. The worst gales, moreover, come from a "blind corner" from which no weather reports are available. Jan Mayen fills that spot, and its importance has just been recognized by Norwegian meteorologists. Professor Bjerknes' knowledge of the scientific and practical possibilities of a wireless station on Jan Mayen had to be supplemented, however, by Engineer Ekerold's enthusiasm and energy before the present station was set going. Ekerold put forward his plans in February, and after an interval of months was finally able to get a grant of about £2000 from the Storthing. After that the affair appeared simple. In reality it was the reverse. To stow the long tree-trunks destined to be wireless masts in the two small ships was in itself a problem not easy to solve. Both ships left Aalesund heavily overburdened with deck cargoes. The next difficulty was to land the gear in the heavy surf. This difficulty too was overcome and the heavy material carried to the chosen site—a small plateau of volcanic sand, but frozen firm as iron at a depth of 2 feet. Work started on August 8; on September 17 the erecting party was able to leave for Norway in the *Isfuglen*, the engine at the station by then being already in running order and both masts (150 feet high) erected. It was possible to speak Norway with a single mast; with both it was a very simple proposition. Weather reports began at once, and continued till September 24. On that day, however, a fierce gale raged all up and down the Norwegian coast; no further wireless messages came through, for in Jan Mayen, owing to faulty couplings, both masts collapsed in the gale. On

October 19, however, Ekerold spoke Norway once more; he and his four companions had succeeded in putting up shorter masts from the remains of the collapsed originals. The station therefore is now at last in running order, and messages are being received daily, sometimes even in this country. It remains for the Norwegian weather bureau to gather and profit by the fruits of Ekerold's painstaking efforts.

Before the paper the PRESIDENT said: Mr. Wordie is well known to you, and you will remember he was with Shackleton on the expedition in which he encountered such great difficulties. Mr. Wordie was several times in Spitsbergen, and he has this summer returned again from the Arctic regions.

Mr. Wordie then read the paper printed above, and a discussion followed.

H.E. the NORWEGIAN MINISTER: I have to express, on behalf of everybody present, our gratitude and thanks to the lecturer for a most interesting lecture. What struck me as a Norwegian was the description of the bareness of this island. In my own country at about the same latitude we have thousands of people living in towns or in the country, and living rather comfortably. Jan Mayen is exposed to the Greenland current, which brings down the pack-ice, whilst Norway has the advantage of the Gulf Stream, which brings life and living conditions to a latitude in which it is not experienced in any other country in the world.

Mr. CHAWORTH-MUSTERS: Mr. Wordie has said that I disagree with him over what he has said concerning the luxuriance of the vegetation. I do not think he has seen two places which I consider to be the "centres" of the flora of Jan Mayen. These two "centres" are a sheltered valley behind Cape Fishburn and a little strip of lowlying land along the north-west coast of the south end. From these centres the flora of Jan Mayen seemed to have originated, some plants occurring at one spot, and others spreading in different radii around them. At Cape Fishburn these species occurred only in the sheltered valley; two species occurred as far as the South Glacier, whilst five species had reached as far as the Willberg and the North Lagoon. This fact seems to point to the conclusion that some plants have migrated to Jan Mayen within very recent times, perhaps as recent as fifty or a hundred years. The isolation and volcanic character of Jan Mayen make the origin of the flora exceedingly interesting. As Mr. Wordie tells me that the island has never been in connection with the mainland, the plants cannot have migrated over land now submerged beneath the sea. The plants must have been transported there by wind, sea currents, or by the agency of animals or birds. There were only two wind-distributed plants on the island; these were a Taraxacum and a Salix; although I believe some of the species with very small seeds are sometimes distributed in this manner. That seeds should be carried far by sea currents is, I think, highly improbable, except in the case of large seeds with waterproof coverings. However, they might be carried in cracks in the driftwood, but I think that they would be knocked out when the wood was smashed by the ice. The most probable means of transport is on the feet of wading birds which stop at Jan Mayen on their way to and from their breeding grounds in Greenland and their winter resorts in the south. The total lack of berry-bearing plants points to the fact that the seeds are not carried by seed-eating birds. The driftwood and other objects washed up by the sea are very interesting. The driftwood comes from the great rivers of

Siberia and consists mostly of logs of coniferous trees. There were also a lot of floats from fishing and submarine nets, wreckage from ships, and I was told by a prospector that he had found bamboos and blocks of rubber and pitch.

Round the coast there were a few wrecks and also the skeletons of whales. In Walrus Gat the beach was covered with the skeletons of whales. I think that these whales had been brought there by human agency, and that it was here that the Dutch whalers must have set up their stations. If any one wishes to visit Jan Mayen to study the old whale fisheries I should advise them to make this spot their base, as I am sure that a careful study of this bay would reveal some interesting relics of the ancient Dutch whalers. Another place of antiquarian interest is the north end of the North Lagoon. Mr. Wordie has also said that there are no reindeer on the island because the vegetation is too scanty. There is, however, another cause which is more probable; this is that there are very few reindeer on the east coast of Greenland, and what there are have plenty of food and would not be forced to cross the ice so far as Jan Mayen nearly 200 miles distant in search of new pastures. There were a good many sea-birds but very few little birds. There were a few snowy buntings and wheatears, and I found a redwing on the sand.

The PRESIDENT: I am sure we should like to endorse His Excellency the Norwegian Minister's expression of thanks to the lecturer. He has taken us into a far-distant island, and we shall hope that as a result of this year's expedition the wireless station will be established and will bring to the Norwegian sailors and seafaring people all the benefits which are expected from it. It must be of enormous advantage to them that they should have, right out in the middle of the Arctic Ocean, a station from which the accounts of the weather and storms that take place there will furnish them with ample warning so that they may be able to make their arrangements accordingly. We should also, I think, give a special vote of thanks to Mr. Chaworth-Musters, because I understand he was the originator of the idea of the expedition. We may hope that his botanical collections will prove of great value and benefit to those interested in natural history.

THE TOPOGRAPHY OF CÆSAR'S LAST CAMPAIGN AGAINST THE BELLOVACI

Henry O. Forbes, LL.D.

HAVING had recently to verify a reference in Dr. T. Rice Holmes's erudite and very scholarly volume on 'Cæsar's Conquest of Gaul,' (2nd ed.) my attention was arrested by that author's discussion on the last Bellovacan campaign, as narrated by Hirtius, because of my intimate acquaintance with the locality now widely accepted as its scene. Napoleon and De Soulcy have identified the sites of the opposing camps to be in the Compiègne forest: the Belgic camp on Mount St. Marc; the Roman on Mount St. Pierre. Mr. Holmes gives his assent to this determination "as the most probable of any that has been named." "It corresponds," he says, "in every particular with Hirtius's description."

During successive vacations I enjoyed many pleasant days, com-

panioned by the Commentaries, in investigating the topography of the struggles of the Belgic Confederation in the Aisne valley, especially that assigned to Cæsar's last Bellovacan campaign, within sight, as it was, of my headquarters in the hamlet of Rethondes.

After careful study of Dr. Holmes's pages and of my own notes I am compelled to retain the opinion I arrived at on the spot, that Hirtius's description of the theatre of Cæsar's operations does not agree with the topographical details of the supposed locality, either on the map or on the ground. I feel driven therefore to conclude that either the Eighth Commentary (chaps. vi. to xxiii.) is defective in details, or that the locale of this campaign has not yet been accurately determined.

The disputed ambit of the drama lies within a belt of country not exceeding 4 miles in width by 10 in length north-westerly from the reputed Belgic camp on Mt. St. Marc, in the corner of the Compiègne forest formed by the confluence of the Oise and Aisne, chiefly in territory belonging to the ancient Suessiones, whose capital stood near the present Soissons.

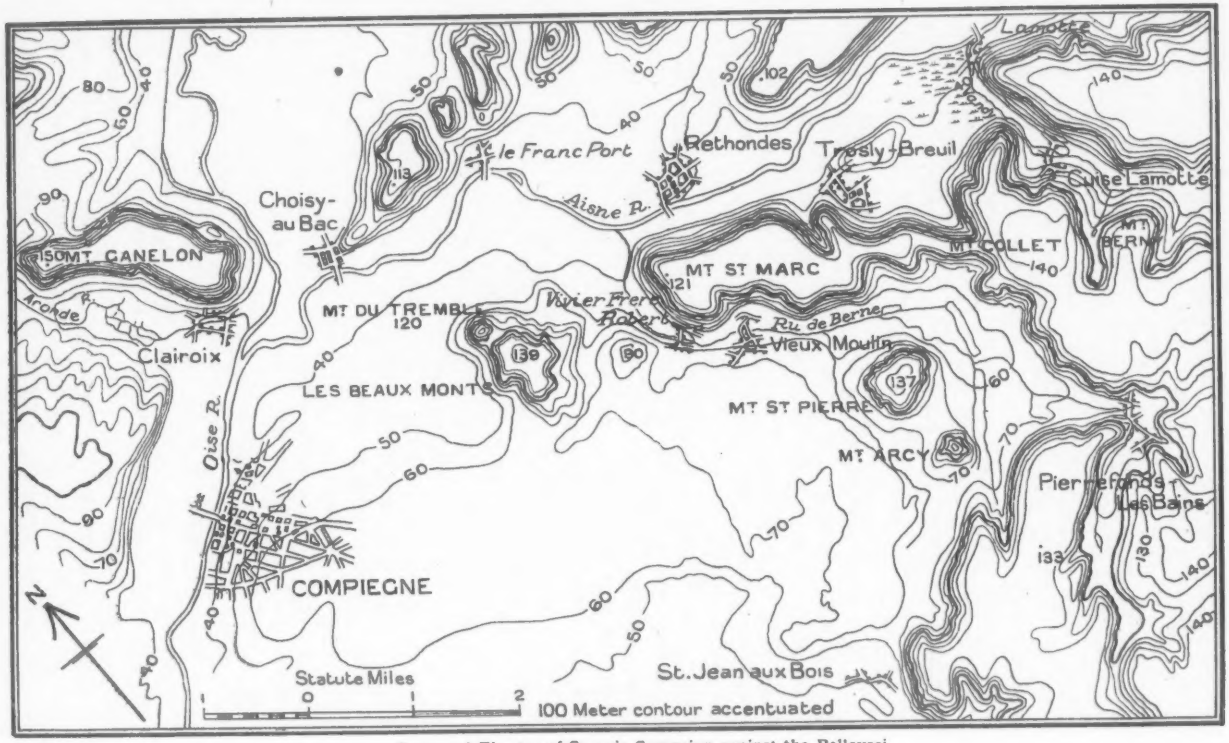
Hirtius's narrative of this campaign opens with Cæsar's being called away, while wintering in Bibracte—whose ruins now lie under the sod on the summit of Mt. Beuvray (Saône-et-Loire)—on December 30 B.C. 53 to quell a revolt among the Bituriges surrounding Guienne. The moment this rising was crushed he hastened back to and reached the Æduan capital on February 8 B.C. 52. Sixteen days later an outbreak, this time of the Carnutes (inhabiting the region about Chartres), summoned him hurriedly to Genebum, now Orleans (Loiret) 130–140 miles to the north-west. While there message after message reached him (probably about mid-March) from the Remi—the people of Rheims, there as now—who enjoyed the title of "the Friends of the Roman People," that the Bellovaci (*qui belli gloriâ Gallos omnes Belgasque præstabant*) had in association with their allies, mustered in great force (*omni multitudine*) with the object of raiding the territory of the Suessiones, who were clients and immediate neighbours of the Remi. Cæsar promptly decided that it was not only urgently necessary to prevent this outbreak from again spreading into a conflagration, but essential also "to teach these tribes that there was no situation which the Roman arm was unable to reach" on behalf of its friends.

Cæsar's preliminary act was to order his lieutenant, C. Fabius, to march from Rheims (where he was stationed) with two legions into the threatened territory of the Suessiones. As soon as he was himself equipped he set out against the Bellovaci and established his first camp (so far as we learn) within their confines—which extended eastward from Beauvais to the Oise—but neither of its site nor of the time or direction taken to reach it has any record survived. On his arrival Cæsar sent out in all directions scouting squadrons whose captives supplied him with the following important information accepted as accurate by Hirtius: that

the mass of the population had migrated elsewhere except a few who, under pretence of engaging in agricultural work, had been sent back (*remissi*) to act as spies (*speculandi causa*); that all the Bellovaci fit to fight were (in confederacy with the five tribes bordering their north-west) encamped, under Correus and Commios, in one spot, a high wooded place (*locum excelsum in sylva*) surrounded by a marsh; that all their impedimenta had been sent into the farthest recesses of the woods; that a few days previously Commios had set out to hire cavalry from the Germans, whose territory lay close at hand (*quorum vicinitas propinqua esset*), and (finally) that the confederates had resolved among themselves that, should the Roman army exceed three legions, they would not attack in the open, but would remain in their elevated camp and harass their enemy by ambuscades.

In these paragraphs we face the first of the many very difficult questions which the narrative raises in the solution of the problem discussed in this paper. Hirtius's defective account gives no indication where the Belgic camp was fixed, except "on a high wooded place." Dr. Holmes, however, remarking on the word *remissi*, considers that the natural conclusion to be drawn . . . is that "it [the Belgic camp] was not within the country of the Bellovaci." May the word not suggest the opposite inference that it was situated within the boundaries of their own or some friendly people, and that the Barbarian farm-hands, on hearing of the approach of the Roman army, fled to some safe retreat among their own folk—whither their impedimenta had been already conveyed—whence some of them had been sent back to serve as spies? It seems improbable that the mass of a population would migrate into the territory of other and hostile tribes.

The identification of the "high wooded place"—the Bellovacan camp—is accepted by the authorities with whom Dr. Holmes agrees as Mt. St. Marc, the north-west promontory of a tableland in the Compiègne forest, and within the territory of the Suessiones, against whom the Bellovacan raid was directed. On reference to the accompanying map, the portion of this tableland known as Mt. St. Marc will be seen to stretch $2\frac{1}{2}$ miles south-easterly, with a height of 121 metres, or about 66 metres above the general forest-level, which slopes gently up from 40 metres on the flats of the Oise and Aisne to 60 or 70 as it approaches the bases of the line of "monts" fringing the forest between the Aisne at La Motte on the east and the Oise at St. Saveur on the south-west. This narrow tableland, varying in width but rarely exceeding one mile at its broadest, continues more or less evenly, nearly in the same bearing, for another $2\frac{1}{2}$ miles along what is successively known as Mt. Collet, Bois de Cuise, and Mt. Berny. From St. Marc to Mt. Collet there is a descent of 10 metres to a narrow neck (in places only $\frac{1}{4}$ mile wide) 1100 yards long, when a rise of 20 metres without special abruptness again takes place—an elevation which is maintained for the rest of its distance that concerns this discussion, except that on the plateau of Mt. Collet a rounded eminence



Supposed Theatre of Cæsar's Campaign against the Bellovaci

($\frac{1}{4}$ mile in diameter) exceeds that level by 10 metres. Meandering close along the western flanks of this St. Marc–Berny tableland trickles the Rû de Berne. The character of the stream to the south of Mt. Collet has little or no bearing on the problem under debate except, it may be observed, that beyond that point occur the more extensive "étangs" one passes on the way to Pierrefonds. To the north of Mt. Collet, the Rû de Berne, in its course to the Aisne, widens in three places into a very narrow pool each less than $\frac{1}{8}$ mile long. The vale bed is grass-clad, and its western margin falls away to the Oise, 6–8 miles distant, which would prevent the ground becoming to any extent water-logged. The rivulet runs between the 60-metre contours which at their widest—just south of Mt. Collet—are barely $\frac{1}{2}$ mile apart. It is evident, therefore, that Mt. St. Marc is not, nor could be, *surrounded* by a marsh, nor is it "protected" by any such wet land of consequence except the swamp between the Vandy and the Aisne on its north-eastern corner near Trosly-Breuil, which is larger and more impedimentous certainly than any tract along the Rû de Berne. It should be specially noted that the swamp *surrounding* the "high place" proved no impediment to the Belgic army and its heavy baggage train (hereafter to be mentioned) crossing over it to reach their elevated camp. To-day, whatever may have been the case in B.C. 52, the ground along both banks of the Rû de Berne is solid enough to carry the railroad past Vivier-Frère-Robert and Vieux Moulin (where the stream has a rocky bottom) to Pierrefonds, and also a carriage road, a branch of which climbs to the St. Marc plateau. The sloping sides of the St. Marc–Berny tableland vary little in gradient, and they cannot be considered "hard to ascend." From Rethondes I have walked up leisurely by the north-west face of St. Marc, across the supposed site of the Belgic camp to its south-easterly edge and back to the village in 45 minutes. One trustworthy guide gives 12 to 15 minutes as the time required to tramp from Vieux Moulin, on the Rû de Berne, to the platform of St. Marc, which commands a fine view up the river Aisne towards Soissons, and north-westward down the valley to Mt. Ganelon. The Bellovaci to reach St. Marc must have marched, apparently unmolested, from their own territory through the forests of their hostile neighbours, constructing ways and bridges or pontoons where required, and finally engineered a road for their waggon-train up an acclivity of 81 metres. One feels at a loss to conjecture by what route Commios could pass with safety from St. Marc to the Rhine through the intervening country of the Suessiones and the Remi, both necessarily hostile to him; or how St. Marc can be at all legitimately described as *propinqua* to the German lands.

The commentary goes on to inform us that the season was still early and fodder and corn scarce when Cæsar, now fully acquainted with the large force arrayed against him, set out from his camp in Bellovacan territory towards the high wooded Belgic rendezvous, with the order of his legions so disposed as to give the appearance of there being only three

(the number the enemy were willing to encounter), with the object of drawing the Gallic army out to fight in the open. Cæsar's unexpected approach to the Belgic headquarters so surprised Correus, that he determined to adhere to the confederate resolve to remain within his safe camp, with his troops drawn up in front of it. Cæsar, on his side, surprised by the ememy's numbers, decided, notwithstanding his anxiety to force an engagement, to construct a camp, for which he selected a site opposite to the enemy's with a valley deeper than wide between their position and his own. This camp be strongly fortified by engineering artifices and powerful artillery, in a specially ostentatious manner, with the object, in part, of inducing the Bellovaci to believe he was "rattled" by their numbers, and so tempt them out, and in part of rendering his camp defensible by a very small force should his foragers require to go far afield.

On studying this further record we find ourselves left in the dark as to the road Cæsar took from his former camp, what rivers, if any, he crossed or bridged—data all ignored by the elusive historian of the campaign. The site of his new camp has however been accepted by Dr. Holmes as Mt. St. Pierre, an isolated pyramidal hill, due south and ¾ mile distant from the nearest part of St. Marc, and about 16 metres higher. It rises steeply on all sides from the forest floor, to a small platform, about ½ mile in its widest part, resting on a base of 30 metres above the river flats of the Aisne and Oise. On its southern side this base, at 600 yards still further south, encircles Mt. Arcy, an isolated monticule whose plateau, 17 metres lower than its neighbour's, is less than 300 yards in greatest width. This St. Pierre–Arcy mass is almost surrounded by two small western tributary rills of the Rû de Berne, while the main stream on its way northward separates also Mt. St. Marc from another (but nameless) elevation, which I shall speak of as Hill 90 (50 metres above the river plain), whose eastern foot approaches within some 500 yards of the western flanks of St. Marc, so as to form a narrow gorge in which nestles the hamlet of Vivier-Frère-Robert. While the description "opposite to" the "elevated place" is a somewhat indefinite one of St. Pierre in its relation to St. Marc, the formation of the Berne valley is certainly discordant with Hirtius's description, for only in the short tract between St. Marc and Hill 90 can the Rû de Berne be said to run in a valley deeper than wide—"a deep and narrow valley" of Holmes—which does not in fact intervene between St. Pierre and St. Marc. Hirtius's text, however, nowhere authorizes the assumption that Cæsar's camp was placed on a hill at all. His ramparts indeed would be superfluous (if one who possesses no military knowledge may venture to make such an assertion) on St. Pierre, whose slopes rendered it protected as sufficiently as, or better than, St. Marc. It is no less evident that engines mounted on St. Pierre would remain ineffective until the Bellovaci, after descending to the Rû de Berne and crossing the morass and the intervening forest-floor in full

view of the Roman sentinels, ventured to approach the base of St. Pierre, when they would at once have afforded Cæsar his sought-for opportunity of attacking them in the open. Indeed, the St. Pierre–Arcy system might—by so numerous an army of the bravest of the Belgians if determined—have been entirely surrounded at a distance beyond engine-range, say 1200 feet, and the Roman camp starved out. More fatal to the identification of St. Pierre as the site of Cæsar's camp is the fact that its plateau (only some 700 yards by 500 in extent) seems to me—subject to correction—inadequate to accommodate the Roman army numbering, on its arrival, four legions with their baggage train, besides numerous German auxiliaries and a "vast number of Remi, Lingones, and other tribes" (of whom he had embodied a large number), probably some 30,000 men in all. It was on this terrain that the rear-guard action was so splendidly fought in the Great War by the 4th (Guards) Brigade, in their retreat from Choisy-au-bac and Rethondes along the Oise towards the Marne in September 1914, when their numbers were reduced to three gunners, who heroically continued coolly firing till, at the last moment providentially reinforced by the [?] 9th Lancers, they destroyed their opponents with the capture of a score of their guns.

Returning to Hirtius's narrative, we learn that skirmishes took place at frequent intervals between small parties who *rushed out* from the opposing camps and played battledore and shuttlecock across the marsh, with alternating success. Cæsar's daily foragers also, "as must necessarily occur" (so Hirtius expresses it) when collecting supplies in an intricate country, out of far-scattered houses (*raris disjectisque ædificiis*), were frequently surrounded, with heavy loss in men and baggage-animals, to the great elation of the Bellovaci, who were additionally inspirited by the safe return, at this juncture, to their camp of Commios with his 500 German hirelings. Cæsar having by then decided that his enemy's "marsh-surrounded elevated place" could neither be directly assaulted without dangerous risk (*sine dimicatione perniciosa*), nor closely blockaded (*munitionibus claudi*) by the force at his disposal, wrote off to Trebonius to join him at his utmost speed with the three legions he indicated. Till their arrival Cæsar's Remian and Lingonian horse were detailed to guard the foragers, for whom, notwithstanding these precautions, the Bellovaci continued successfully to lay snares in wooded spots (*in sylvestribus locis*), in one of which it was the ill luck of the Remi to suffer very severe loss, including their chief Vertiscus. Contests also at the ford and pass of the marsh still occurred daily in full view of both camps. In one of these encounters Cæsar's auxiliaries determinedly crossed the marsh, killed the few who resisted them, and so hotly pursued the remaining crowd (*reliquam multitudinem*) in reserve, dislodging them time after time from the higher grounds (*locis superioribus*) that they fled without drawing breath till they got back into their own camp, and some in their terror ran even beyond it. This defeat so filled Correus's army with foreboding,

to be greatly intensified, a few days later, by the news of Trebonius and his legions being not far off, that, with minds still heavy with the remembrance of the recent disaster at Alesia (Alise-Sainte-Reine on Mont Auxois), they resolved to escape, and began as soon as darkness fell to send away in advance their enormous waggon train (*magna multitudo carrorum*) with the baggage, all their unarmed men, the aged and the invalids. Daybreak, however, having exposed their operations, they attempted to prevent the Romans pursuing the train till it was well under way, by drawing up their troops in front of their camp. On observing Correus's alertness, however, Cæsar deemed it unwise, with so steep a hill facing him, to attempt its attack.

It is equally obvious from the map as to any observer on the spot, that if the true positions of the belligerents were on St. Marc and St. Pierre, the expression *procurrentibus* (rushing out) used in the above continuation of the narrative, suggests a very different situation from that of camps perched on steep eminences 2 miles apart. And if they were, as presumed, situated within Suessonian territory, which was friendly to the Romans, one would have expected the well-disposed owners of the scattered farms to have brought in supplies for their benefactors, or at least to have spied out for them the dangerous wooded places, and certainly the last to fall into these snares ought to have been the Remi—of whom the Roman foragers contained a large number—who as friends and bordering tribes of the Suessiones would be familiar with the country. The fact also of the safe return of Commios from the Rhine with his 500 hired cavalry, besides supporting the indictment I have brought against the high wooded place as St. Marc, throws the upholders of this identification on the horns of a dilemma. To have reached this camp Commios must either have conducted his cavalry round through friendly country to the north, thence eastward across the intervening forest and obstructive rivers of hostile Suessonian territory, marching them brazenly under the never unobservant eyes of Cæsar, whose position, by hypothesis, gave him full command of the approaches of St. Marc; or his squadrons must have crossed right through Remian and Suessonian country (tribes both long bound by ties of friendship to the Romans) entirely without opposition, or any warning conveyed by spies or sentinels. The statement that Cæsar contemplated the investment of the Belgic camp still further compels the conclusion, after an inspection of the map, that Cæsar's eyes were set on some other elevated place than St. Marc, and one, besides, at a distance from it; for instead of sending in great haste more than 100 miles for Trebonius's legions, he had, as will be remembered, two of Fabius's within very easy call, somewhere between himself and Rheims, probably at Soissons, the Suessonian capital. Strangely enough nowhere, except in the early passage referred to, is this officer or his legions mentioned again throughout the campaign. In addition to these considerations, neither on the map nor on the actual ground can

any spot, in full view of the two presumed camps, be recognized answering to "the ford and pass of the marsh."

The account of the successful raid by Cæsar's auxiliaries (described in one of the above paragraphs), in which the Belgic "elevated place" (the dreaded marsh and the acclivity notwithstanding) was apparently almost, if not entirely, reached, and its army mortally scared, although it does not invalidate the contention I am supporting, yet it leaves us hopelessly perplexed; for this handful of troops evidently accomplished with little opposition what Cæsar, after mature consideration, had decided to be too "pernicious" an adventure to attempt; and, what is more unaccountable, he did not, on observing their success, strongly reinforce them at once so that the position might have (as may be gathered from the narrative) been fully captured. When the theatre of these operations has finally been identified, Hirtius's story—defective even as it is—may present a different aspect. The fact that Commios could conduct his levies safely to his camp without Cæsar's apparent knowledge or interception, while accurate information of Trebonius's approach—as to whose line of march Hirtius is silent—was conveyed to the Bellovaci, further strengthens my previous contention that the latter were encamped in a friendly country, additionally confirmed by the presence in their camp of the crowd of men unfit to fight and of non-combatants who were sent away with the baggage train. No troops that Correus could draw up *on St. Marc* (if that hill be the "elevated place"), to cover the departure of his baggage train, could possibly prevent its *pursuit* by the Romans, who were, by supposition, in occupation of the forest-floor, 66 metres immediately below his camp, and in command of the only road by which his carts could escape towards Mt. Ganelon, *i.e.* down its north or north-west slope facing the Aisne, and thence down the valley. This exit from St. Marc could, I venture to suggest, have been blocked by a troop passing between Hill 90 and the *massif* (if it may be so described) of the Beaux Monts and Mont du Tremble (the most prominent of the heights within the Compiègne forest), by an existing gap $\frac{1}{4}$ of a mile wide, very little, if at all, above the forest-level at the base of St. Pierre; or the Belgic train might have been cut off by marching even to the west of this block by an attack on its flank opposite Choisy-au-bac. The narrative fails to mention the destruction of the train or of its subsequent fate; but it is evident it was allowed to escape unmolested, a different fortune, one may predict, than would have befallen it had Cæsar really occupied St. Pierre.

Cæsar realizing, so the Commentary continues, that his camp was cut off from Correus's by a marsh difficult to cross, but that the hill (*jugum*) on its far side, stretching almost to the Belgic position, was separated from it only by a mediocre valley, he bridged the marsh and leading over it troops of all arms quickly mounted its plateau, and advanced his artillery so close to the edge of the hill that missiles could be discharged into the midst of the enemy. As the Bellovaci, refusing to be drawn,

pertinaciously remained on their own ground, Cæsar, under a guard of twenty cohorts, had a third camp constructed and fortified with his troops drawn up ready for eventualities. The Bellovaci, interpreting these manœuvres as preliminary to their pursuit (*insequendum*), in their terror determined to hasten after their waggons, and so at dark (*extremoque tempore diei*), after raising a dense smoke-screen, they took to flight (*vehementissime cursu*). Suspecting their intentions Cæsar advanced his cavalry (over the mediocre valley evidently) to the edge of the smoke-screen, which however their horses refused to face, while he followed, in person, cautiously in case of a snare. During the night the Belgic host escaped unpursued and unharmed (*sine ullo detrimento*) to a very strong place 10 miles distant, from which many traps were placed by Correus for the Roman foragers, wherein they suffered severely. One especially elaborate ambush, Cæsar learned from a prisoner, was planned at a flat place a mile square, rich in grass and corn likely to tempt the Roman victuallers, for whom 7000 of the bravest Bellovaci under Correus himself were to lie in wait. This field was encompassed by extremely dense forest and a river most difficult to cross (*flumine impeditissime*) some 8 miles from the "very strong place."

In studying the further progress of the campaign in the above paragraphs, one's surprise grows at the constant anxiety—if St. Marc were the elevated place—which the marsh caused, since it seemed to form no real obstruction, for, even according to Hirtius's confused and indefinite narrative, it had been crossed, as we have seen, many times by large bodies of horse and foot from both camps. A very crucial difficulty, however, exists in the position of the *jugum* stretching within arrow-flight of the Belgic troops. Dr. Holmes seems to agree to the identification of this hill with Mt. Collet. It is impossible not to be struck by the apparent ease with which Cæsar at last crossed the dreaded marsh (probably by a corduroy road) and ascended the *jugum* (which, if Mt. Collet, is as high and has as steep flanks as St. Marc) after he had considered both obstacles practically insuperable. Mt. Collet the map shows to be only a continuation of an undulating tableland, as already described, nowhere interrupted by any feature a geographer would describe as a valley "mediocre" or other. St. Marc and Mt. Collet, differing in height by less than 10 metres, are united by a narrow neck 1100 yards long and only 10 metres below their level. The extreme edge of this hill (*ultimum jugum*) from which darts could be showered on the Gallic troops is, if on Mt. Collet, more than 2 miles from the centre of St. Marc's plateau, and therefore of Correus' camp, while the range of the Roman *tormenta* rarely exceeded 1200 feet. Cæsar's fears of a trap on the "elevated place" raises further doubt as to its being St. Marc, since no ambush could be set, within so limited an area too, more numerous or dangerous than the entire Belgic army, which Cæsar had realized was then "on the wing," while his own veterans (perhaps

then augmented by Trebonius's legions) were alert and ready for anything. Some reason, which the geography of the Compiègne forest does not suggest, must exist why Cæsar, "who was adventurous as a knight-errant," allowed first the Belgic waggon-train and then the entire army to escape absolutely unmolested. The information we possess affords no authority for assuming that the direction taken by Correus from his deserted camp was "*up* (*lapsu calami* by Holmes on page 830 for *down*) the Aisne," or that the "very strong place" must be identified with Mt. Ganelon, for *loco munitissimo* does not necessarily indicate an eminence. This isolated table-topped hill rises just within the Bellovacan territory to about 110 metres above the Oise at its confluence with the Aisne, and the centre of its plateau is distant from St. Marc's, as the crow flies, about $5\frac{1}{8}$ English, or between 5 and 6 Roman, miles, a wide discrepancy from Hirtius's 10 miles, even if his measurements followed the river. Between these places lay, for a large army, two extremely difficult physical obstructions—the crossing of the deep and unfordable rivers Aisne and Oise, or (according to the bank followed) of the Oise and then the Arvonde marshes at the base of Mt. Ganelon, and the ascent of the steep flanks of that hill, a trek—passed over in Hirtius's narrative in silence—which ought to have become a rout if it had taken place in the Aisne valley. Some unrecorded reason must surely also exist for Cæsar's continuing to remain in the vicinity of the deserted camp of the Bellovaci after their flight, and the repeated disasters to his foragers, not to be explained by the geography of the Compiègne forest. The luxuriant cornfield—indicating a cultivated district, and the likelihood of espionage—selected for Correus's ambush (planned evidently for days previously since it was known to the Belgic prisoner) was 8 miles from the strong place; but nothing is related to be a guide to its identity beyond the unhelpful indications of "the very dense forest" and "a river most difficult to cross." From the former Belgic camp on St. Marc, as presumed, the field may have been any distance between 2 to 18 Roman miles, which in case of the former would be less than 2 English miles off and easily visible, but for tree-obstruction, from its plateau. A cornfield too so luxuriant, if within such immediate reach, must certainly have long before been pillaged by one or other army, both of which had been foraging far and wide for weeks previously. Since "in vain is the net spread in the sight of any bird," it seems incredible, if the belligerents were not *playing* at soldiering, that Correus could hope to march 7000 men, cavalry and infantry, secretly over the great physical obstacles between Mt. Ganelon and the field, and spring a surprise upon Cæsar's foragers in the near vicinity of their camp; or that he would conduct under the nose of the Roman general a fraction of an army which incontinently fled *en masse* a few days before from fear of the Roman legions, where the ambuscaders could be cut off, in case of reverse, from any help by their fellows. I am constrained to conclude that the beguiling cornfield could not have been situated, the authorities

already quoted notwithstanding, in the Aisne valley, at least below the entrance of the Rû de Berne. Eight miles *up* the Aisne from the plateau edge of Mt. Ganelon, even following the river windings, would take Correus' force far eastward of Mt. St. Marc and absolutely within sight and hearing of Cæsar's legions.

According to the narrative, Cæsar, to counter this plot, pretending ignorance of the ambush, despatched in advance to the cornfield only a somewhat augmented foragers' guard, which he was personally to follow after at his utmost speed at the head of more legions than usual. These advance troops fought the ambuscaders fiercely, but they had to give way for a time; and though the light infantry joined in, the issue of the contest was for a long time doubtful. Meantime Cæsar, while marching along at top speed, kept sending ahead messenger after messenger to the battle-field to announce that the legions were hurrying to the aid of the guard, ready for action. These messages inspirited the fighters to exert their utmost to finish the fight before the legions should arrive and claim a share in their victory. When Cæsar did reach the scene, the Bellovaci had been entirely defeated with the loss of the greater part of their number, including Correus their general. In expectation that the enemy would, after such a defeat, vacate their camp, Cæsar determined to march his force thither—some 8 miles distant—even across a deep river which he discovered (*videbat*) blocking his way; but the Bellovaci, then finally crushed, submitted and sent hostages who met Cæsar before he reached the "very strong place."

Cæsar's reputed camp was then, by hypothesis, on the St. Marc plateau or its neighbourhood, and within 3000 yards of the meadow where the *long* and desperate conflict was being waged, a distance no greater than an ordinary pedestrian could accomplish in less than half an hour. The fact that Cæsar, at his top speed, failed to cover this short distance and reach the field before the finish of the battle, and that he was sending out relays of messengers during his flying march over the intervening 3000 yards, is sufficient evidence that the distance from his camp to the scene of the struggle must have been far in excess of 2 Roman miles, and if so it is conclusive that the scene of the battle could not have been in the lower Aisne valley, and if not in the Aisne valley neither were Mts. St. Marc and St. Pierre the sites of the respective Belgic and Roman camps. Had this battle been fought really in the Aisne valley Cæsar, with a camp on St. Pierre, did not, it is perfectly obvious, require to "discover" the river flowing between the field and the "very strong place"; it must have been hourly in evidence during his occupation of Mt. St. Pierre.

I am finally compelled to conclude that, through the indefiniteness and lack of details in Hirtius's narrative—more than one instance of which has been noted above—or his lack of personal knowledge of the locality, the problem which has occupied us is, as M. Desjardins believes, insoluble with our present knowledge.

THE MOUNT EVEREST EXPEDITION

THE preparations for this year's expedition are now complete, and the nine members going from England have left for India. They are:

Brig.-Gen. the Hon. C. G. Bruce, C.B., Chief of the Expedition.
Lt.-Col. E. L. Strutt, C.B.E., D.S.O., Second-in-Command.
Mr. G. L. Mallory, who led the climbing party in 1921.
Mr. George Finch, of the Imperial College of Science.
Major E. F. Norton, D.S.O., R.F.A.
Mr. T. Howard Somervell, F.R.C.S., of University College Hospital.
Dr. A. M. Wakefield, of Megantic, Quebec Province.
Dr. T. G. Longstaff, Surgeon and Naturalist.
Capt. J. B. L. Noel, M.G.C., Photographic Officer.

The party will be joined in India by Capt. Geoffrey Bruce, 5th Gurkhas, and by Captain C. J. Morris, 3rd Q.A.O. Gurkhas. The twelfth place was to have been filled by an artist; but to the great disappointment of the Committee it was not possible to find one, among those whose methods seemed appropriate, that could undertake the journey.

Of the eleven members of the expedition named above six are soldiers: three of the Gurkhas, one of the Royal Scots, one Royal Field Artillery, and one Machine Gun Corps, formerly of the East Yorkshire Regiment.

Three members of the party are of Cambridge University: Mr. Mallory of Magdalene, Mr. Somervell of Caius, and Dr. Wakefield of Trinity. Two are of Oxford University: Colonel Strutt and Dr. Longstaff, both of Christ Church. Three are surgeons; two are naturalists; several are expert photographers; one at least is a painter; and all are distinguished mountaineers. It is, in fact, a very strong party, of which much is expected.

We hope to publish in a future number of the *Journal* an account of the climbing equipment, which includes an oxygen apparatus specially devised for the occasion.

The photographic outfit is very complete, including three cinematograph cameras, of which one is equipped with a battery of lenses up to 20 inches focal length; two panoramic cameras, of which one rotates through the complete circle; four cameras for glass plates, including one 7½ by 5 inches, all fitted with telephoto lenses; one stereoscopic camera; and five Kodaks; besides a variety of private cameras belonging to different members of the party. The dark-room equipment includes all that is required for developing cinematograph films in the field.

REVIEWS

EUROPE

The British Isles.— **A. B. Archer.** Pp. 224. **The Continents of the South.**— Same Author. Pp. 272. London : W. Heinemann. 1915 and 1921. *Illustrations and Maps.* 4*s.* 6*d. each.*

THESE are respectively the first and second volumes of a series planned to cover in six volumes a four-years' secondary school course in geography. The first volume is intended for pupils of twelve years of age: subsequent volumes are graded up to matriculation standard. The author adopts the sound method of regional treatment throughout, introducing in supplementary chapters more comprehensive treatment of the principles of geography. The first volume is divided equally between the British Isles as a whole and regional treatment of the country. The second volume deals with South America, Africa, and Australia, which are followed by a few pages on seasons and climate. The existence of a fourth southern continent, Antarctica, is ignored. Considerable emphasis is laid on vegetation regions in each continent, but the regional notes are very brief indeed. Illustrations and maps are well chosen. R. N. R. B.

Søkortdirectør Jens Sørensen, "den Danske Hydrografis Fader," 1646–1723, et Bidrag til det Danske Søkortvæsens Historie. Af Johannes Knudsen. Udgivet ved Marineministeriets Foranstaltning af det Kongelige Danske Søkort-Arkiv. København : 1918.

Jens Sørensen, the subject of this memoir, was born in 1646 at Sølvitsborg in Blekinje, then under the rule of Christian IV. of Denmark. His father was a shipowner, skipper, and merchant, and he himself was engaged in the same occupations. During the war which broke out between the Swedes and Danes he suffered great losses, and in 1677 he took refuge in Copenhagen. In 1686 he settled in Kjøge, where he continued his business more or less until 1712, when he removed again to Copenhagen, and died there in 1723. From 1682 he began to draw charts from observations made during his voyages, and from 1689 was employed by the Danish Government, receiving in 1695 the title of Director of Sea-charts. His life was a troubled one ; he suffered losses in Sweden, was at loggerheads with his neighbours in Kjøge, had great difficulty in obtaining vessels and equipments for his surveys, having frequently to dip into his own pocket, as his pay was sometimes several years in arrear, and in 1720 he was summarily dismissed from his post. The Danish exchequer was exhausted by the war of 1709–20, and perhaps Sørensen's "peculiar temper," mentioned by the Danish Admiralty, may have been partly the cause of his misfortunes.

Sørensen's charts were compiled solely from compass bearings and distance measurements. He did not take a single observation of latitude, nor did he know anything of projections, and therefore his charts are not furnished with a network of degrees. The result, however, of his careful and painstaking work is that his charts compare very favourably with others of the time, whether executed in Denmark or other countries, and he rendered great service to mariners by indicating almost all the banks and reefs dangerous to navigation. On land also he did good work. Finding that distances on Danish roads were uncertain, he drove over the Danish peninsula and some of the islands in a "mile-cart," on which a bell was rung after the wheels had made a certain number of revolutions, and thus obtained a rough but much improved basis for his surveys.

Herre Knudsen's work contains a biography, an account of Sørensen's hydrographic work, etc., and is illustrated with reproductions of some of his chief charts with the true outlines indicated for comparison, and two or three other contemporary charts. W. A. T.

ASIA

The Angami Nagas, with some Notes on Neighbouring Tribes.— J. H. Hutton, C.I.E., M.A. (I.C.S.). London: Macmillan & Co. 1921. 40*s. net.*

This is a good specimen of the modern method of anthropological research by monograph, or the intensive study of a single community. In this case moreover, the subject appears to be one to which this mode of treatment is specially appropriate, in that the rugged hill tract occupied by the tribes known collectively as Naga has had an unusually separative influence upon immigrant communities of undoubtedly identical origin. To this may be added the continuous intertribal warfare which subsisted up to the present generation, and necessitated the segregation of the inhabitants on the best fortifiable hilltops. Thus, while the seven main divisions of the Naga dwelling in the tract under British administration probably started from some common region far to the south, they now present a very marked diversity of physique, dress, customs, and language. On the other hand, there seems some reason to expect that under the influence of settled government, increased material prosperity, missionary enterprise, and closer intercourse with the Brahmanized population of the plains, much of the above diversity will in no long time be levelled into comparative uniformity. This, however, is a prospect which lends point to the plea urged by the author, in common with most administrators of similar tracts, for the speedy investigation and record of a social life the traditions and practices of which are fading into oblivion. Students of anthropology, therefore, and others interested in descriptions of the less developed communities on the fringe of British Dependencies, will be glad to learn that this monograph is to be followed by similar studies by the same author and his colleagues, dealing with other important branches of the Naga, such as the Sema and Lhota.*

Mr. Hutton disclaims the title of trained anthropologist, but his notes show that he has read widely and well on the subject, and knows what material to collect and how best to arrange it so as to help on the work of those who have not his own advantage of intimate personal acquaintance with the people he describes. Furthermore, the results of his experience are classified under well-chosen general heads, which are to be adopted in the forthcoming monographs mentioned above. In this way comparison with other communities is facilitated—an essential point, only ranking below accurate original inquiry. As to this last, the general tone of the book inspires confidence. The author is in complete sympathy with those about whom he writes, and they with him. Had it not been so, the remarkably intimate and interesting details he sets forth would not have been divulged to alien ears. J. A. B.

AFRICA

Studies in North Africa.— Cyril Fletcher Grant. London: Simpkin. 1921. *Illustrations.* Pp. 256. 8*s.* 6*d. net.*

This is a new edition, revised, of the first part of a volume, ''Twixt Sand and Sea,' published in 1911 and reviewed in the *Journal* for August 1912 (vol. 40, p. 206). As was then said, Mr. Grant gives a most attractive account of the vary-

* Mr. Hutton's work on the Sema Nagas has since appeared.—ED. *G.J.*

ing fortunes of that part of North Africa now known as Algeria and Tunisia, from the beginnings of Carthage to (and including) the days of the Barbary pirates. The present volume forms the historical part of the original work and is complete in itself. The illustrations (nearly all photographs of Roman ruins) are very good ; it is to be regretted that a suggestion of supplying the work with maps has not been followed, as the geographical interest is strong. Nor is there any index. F. R. C.

Three Travellers in North Africa.— **The Hon. Emily Ward.** London : John Lane. 1921. *Illustrations and Sketch-map.* Pp. xii. and 224. 6*s. net.*

Miss Ward gives us a very pleasing, unassuming account of a four months' tour in Algeria and Tunisia, her companions being the Hon. Agnes Leigh and Lord Leigh. The last named contributes sections, mainly on sport, to the book. Miss Ward has an observant eye and is quick to catch the atmosphere of her surroundings, whether she be in the desert, in the hill country, among ancient ruins, or in some oriental town. She has shrewd and kindly comments upon the people, and gives practical details of much service to those who may wish to see what she has seen—and that includes most of the places worth visiting. The map shows the itinerary clearly.

Mogreb-el-Acksa : a Journey in Morocco.— **R. B. Cunninghame Graham.** London : Duckworth. 1921. Pp. xi. and 300. 18*s. net.*

Mr. Cunninghame Graham's account of his attempt to reach Tarudant in 1897, which now appears in a new edition, is as readable, and as valuable, as when it was first published in 1898 (there appears to have been no intermediate edition). He gives a vivid picture of the Morocco of those days—that is, before the era of the French protectorate and when over a great part of the country the Sultan's authority was barely acknowledged. There is no need to dwell upon the merits, or the defects, of Mr. Graham's style ; he writes a traveller's tale as well as anybody and better than most, so that while reading this book we live his life for the time being. And there are many advantages in travelling by armchair in the Morocco of oriental misrule and anarchy which he describes.

This edition is stated to have been revised ; but, we believe wisely, no attempt has been made to introduce into it any account of events since the journey was undertaken. Still a revision might have included a table of contents, an index, and a map, if not illustrations. All these things the book lacks. F. R. C.

AMERICA

The Geography of Illinois.— **D. C. Ridgley.** Pp. 385 + xvii. University of Chicago Press. 1921. *Maps and Illustrations.*

This small volume is the first of a series of regional geographies of the United States under the general editorship of J. P. Goode. Although it is of course mainly of value to American students, the series will eventually afford the standard source of information on the geography of the United States. The division by state boundaries is a little artificial in some aspects of the work, but it is admittedly no easy matter to select more satisfactory frontiers. The treatment is genetic, but most of the chapters are thoroughly geographical in outlook, even if others, such as the chapter on cities, tend to fall into the style of the encyclopædia or guide-book. The volume is, however, designed for the

general reader as well as the student, which justifies the inclusion of some matter not strictly geographical. There is a great deal of useful statistical matter. The illustrations are both numerous and well chosen, and there are several coloured maps. We hope that the number of volumes in this series will grow rapidly. R. N. R. B.

POLAR REGIONS

South with Scott.— Captain E. R. G. R. Evans, C.B., R.N. London and Glasgow: Collins. 1921. *Frontispiece and Maps.* 10*s.* 6*d. net.*

Captain Evans says in his Preface that "The object of this book is to keep alive the interest of the English-speaking people in the story of Scott and his little band of sailor adventurers. It is written more particularly for Britain's younger generations." If only on that account the book deserves to be widely read; it is written in a simple yet interesting way, with occasional exciting interludes. Especially good are the accounts of the winter journey to Cape Crozier, of how Crean and Lashly took charge when the author fell a victim to scurvy (pp. 223–225), and of how the Northern Party lived through a winter on little food but a keen sense of humour. A good deal of important new matter is also to be found scattered through the pages of the book—a full account of the beginnings of the Expedition, Scott's carefully thought-out and lucid instructions to his subordinates, and finally quotations from Bowers' diary. It should appeal therefore to the small public interested in all polar work, and can be thoroughly recommended as a useful addition to Antarctic literature. There are some sledging hints, the outcome of the author's own experiences. He might perhaps have said more about the difficulties of snow at very low temperatures; this was one of the reasons put forward for Scott's breakdown, but is it well substantiated?

In more than one place Captain Evans pays a fine tribute to the ability and energy shown by Dr. Atkinson, who became leader of the Shore Party on account of Evans' compulsory return to New Zealand. This is worth noting by reason of attempts made recently in some quarters to disparage the author. It is surely common knowledge that, following Scott's death, Evans as second in command became head of the expedition, but was unable owing to ill health to assume the duties of leader on the spot till the *Terra Nova* returned after the second winter to bring back Campbell and Atkinson's parties. There is nothing in the present narrative indicating a desire for more credit than is properly due; one even regrets that the author has succeeded only too well in almost entirely suppressing his own personality. The book runs to 284 pages; the moderate price is due to there being no illustrations, with the exception of the frontispiece and three useful maps. J. M. W.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Factors for Converting Rectangular to Geodetic Co-ordinates between parallels 48° and 60°. Computed by **C. E. Tildesley, A.C.G.I., A.M.Inst.C.E., B.C.L.S.** British Columbia: Department of Lands.

Relation between Plane Rectangular Co-ordinates and Geographic Positions. Walter F. Reynolds, Chief Geodetic Computor, U.S. Coast and Geodetic Survey. Washington, D.C., 1921. Special Publication No. 71. *Price* 10 *cents.*

Any means of shortening the computation work of the surveyor is to be commended provided there is not loss of accuracy in the result, and with that

object in view the above sets of tables for converting rectangular to geodetic co-ordinates, and *vice versâ*, have recently been prepared for the use of Government surveyors in British Columbia and the United States.

Last year Mr. Tildesley forwarded to the Society a small set of tables which he had computed for use in British Columbia, giving factors for every 10 minutes of latitude between the parallels of 42° and 60°, and he has now brought out a more complete and extended set, with additional tables, giving the logarithmic factors to seven and four figures for every minute of latitude from 48° to 60°. These limits include the whole of British Columbia, where they are specially intended for use; but of course they could be used equally well in any part of the world within these limits of latitude.

Mr. W. F. Reynolds, of the U.S. Coast and Geodetic Survey, has recently brought out a set of tables for the same purpose as Mr. Tildesley's for the United States, extending from the 24th to the 49th parallel, and giving values for every 10 seconds of latitude, together with the logarithmic factors to seven and five figures. The two sets supplement each other, and should be very useful in shortening the computations of the surveyor. Although the arrangement and method of computation is somewhat different, both Mr. Tildesley's and Mr. Reynolds' tables are arrived at by rearranging the lengthy fundamental formulæ and combining certain quantities so as to form constant logarithmic factors for the various latitudes. Where the latitudes overlap it is possible to compare results, and it will be seen that in the last figures of the logarithms there are at times considerable differences. Mr. Tildesley has based his tables on Clarke's 1866 figure, while Mr. Reynolds states that he has in his computations referred to Hosmer's Geodesy, where the tables are also from Clarke's 1866 figure, and to tables in manuscript form by Mr. L. A. Chase.

Mr. Tildesley's latest tables are not yet in print, but are photographic reproductions of the manuscript; but it is hoped that they will be published before long in pamphlet form by the Department of Lands of British Columbia.

E. A. R.

GENERAL

Nile and Jordan: an Archæological History of the Inter-relations between Egypt and Palestine, from the earliest times to the Fall of Jerusalem in A.D. 70.— G. A. Frank Knight, M.A., F.R.S.E. London: James Clarke & Co. 1921. 8vo. Pp. xii. 572. *With five Maps.* 36*s. net.*

The author's object is "to trace the various links which united these continuous territories," Egypt and Palestine. He has searched for them in more than 1700 volumes and journals, of which an alphabetical list is given in an appendix. His perspective in time is explained in another appendix: from Solomon's Temple he reckons back to Abraham's birth, allowing 175 years for his lifetime, 180 for that of Isaac, and 110 for that of Joseph. Biologists will form their own opinion of these estimates. The birth of Moses in 1525 B.C. "exactly harmonizes with the period when Hatshepsut was a princess but not yet full queen of Egypt" (p. 517); so it must have taken a long time. Geographically, Dr. Frank Knight is concerned to show "how misleading such a conception is" as that "Egypt is an integral part of Africa, and Canaan as unquestionably belongs to Asia" (p. 1). Analysis of the species of fishes, for example, from the Lake of Tiberias and the Jordanic basin "points, not to any affinity with the fauna of the Orontes or of the Euphrates, but to that of Tanganyika and the other great African lakes." Josephus made a similar observation; but a good deal has happened to qualify conclusions from

this. In early human times, for example, there are differences; the "mammoth race" of the Rephaim, a branch of the "primitive Neolithic stock," does not seem to be represented in Egypt—and in fact no specimens are extant in Palestine either; but though the "Syrian type" of megalithic monument "never advanced beyond the rude massive structure" (how big are the Syrian cist graves?), "it is fascinating to trace clear analogies to the pyramids of Egypt" (p. 27). Other "clear analogies" have fascinated the author in the course of this vast compilation, and detract from its usefulness. More fortunate than Fluellen's researches on the rivers of Monmouth and Macedon, 'Nile and Jordan' is published "with the assistance of a generous grant from the Carnegie Trustees for the Universities of Scotland"; but it does not greatly assist the study of either of its eponymous rivers.

J. L. M.

Petroleum.— Prepared jointly with **H.M. Petroleum Department** with the co-operation of **H. B. Cronshaw, Ph.D.** Pp. 110 + x. London: John Murray. 1921. *Price 5s. net.*

The Imperial Institute has done good service in the preparation of its series of monographs on mineral resources. Each volume has special reference to the British Empire, but includes the whole world in its survey. We notice that British oil resources are briefly dismissed, no doubt meriting little attention. There is a short introduction on the characteristics and use of petroleum and a full bibliography. The volume though small is packed with information, and should be useful by reason of its authoritative nature.

Travel in the two last Centuries of Three Generations.— Edited by **S. R. Roget.** London: T. Fisher Unwin. 1921. Pp. 254. *Illustrations.* 16*s. net.*

This volume consists of a selection of extracts from the diaries of travel made by three generations of a well-known Genevese family. Like many citizens of Geneva in the eighteenth century the Rogets had close connections with England. Jean Roget (1750–1783), the eldest of the three diarists, was for a time the pastor of the French Protestant Church in London, and married a sister of Sir Samuel Romilly. After his return to Geneva he kept up an interesting correspondence with his brother-in-law dealing with the politics of his native city, which has recently been published. His son, Dr. Peter Mark Roget (1779–1869), was for twenty years Secretary of the Royal Society, was a versatile writer of scientific papers, and edited a 'Thesaurus of English Words and Phrases' which went through several editions. His grandson Jean Louis Roget (1828–1908) was an artist of merit with—as is proved by the illustrations here given—a keen power of observation both as to architecture and human types. He also wrote a history of the Royal Society of Painters in Water Colours. The present work has been put together by his son out of the family papers at his disposal. His chief aim, he tells his readers, has been to bring before them "the magnitude of the changes in the methods of locomotion that have taken place during the last hundred and fifty years." He apologizes for his material being in part "commonplace and unexciting." We regret to have to accept this description. From writers so variously distinguished we had hoped for more vivid and picturesque descriptions of the incidents and humours of road-travel and the packet-boat in the days of our grandfathers. But these diaries are, as a rule, no more than ordinary tourists' notes: one does not care to be told of a voyage on Lago Maggiore on which "I stood on deck with mackintosh and umbrella all the time, but saw very little. Borromean islands,

ugly built-up things. Colossal statue close to a house near Arona. I don't like it." There is a great deal too much of such trivial detail. The persistent reader, however, may lay down the book with a renewed appreciation of the uncertainties of a journey to the Alps when the voyage from Dover to Calais might take fifteen hours, or you might be kept waiting a week for a favourable breeze; and the choice, once across the Channel, lay between slow and crowded diligences or recourse to the jobmaster at Charing Cross who let out carriages to parties of four or five persons for the drive across France.

The journeys here recorded include, besides those to and from Switzerland, a drive to Edinburgh, walking trips on the Moselle, and visits about 1855 to Paris and Holland. Notes on a journey in the United States in 1818 are added, but they are not of much account.

The most interesting chapter is that in which Dr. Roget recounts his difficulties in making his escape with his pupils from Geneva in 1803, when Napoleon had ordered the arrest of all English subjects in France. Geneva, of course, was at that time French. Dr. Roget succeeded in obtaining a certificate that he was a "ci-devant Génévois," and thus avoided being sent to Verdun with the rest of the English in the town.

The footnote on p. 57 calls for correction. It repeats the Bourrit–Dumas story as to the first ascent of Mont Blanc. Jacques Balmat did not "struggle on alone, afterwards rescuing Dr. Paccard, who was overcome by exhaustion before the goal was reached." It is time this legend, which has been conclusively contradicted on the authority of eye-witnesses, was put an end to, and it ought not to have been repeated by a member of the Swiss Alpine Club.

World Atlas of Commercial Geology. Part I. Distribution of Mineral Production.— Washington: United States Geological Survey. 1921. Pp. 72. *With 75 maps.*

The United States is rightly very proud of its "national primacy in mineral wealth." In 1913 it produced of the world's total output of coal 39 per cent., iron ore 36 per cent., petroleum 65 per cent., copper about 60 per cent., lead 36 per cent., zinc 36 per cent., sulphur 51 per cent., phosphate rock 45 per cent., and its importance as a producer of these minerals and metals is not likely to decrease for a long time to come.

Of the less common minerals, chromium and tungsten ores may be mentioned as examples of ores of which the United States, though an insignificant producer in 1913, became a leading producer during the war. Indeed, war conditions demonstrated, more effectively than ever peace conditions had done, the vastness of the actual and potential mineral resources of that country, so much so that it might be expected to be free from all anxiety as regards its mineral supplies.

Mineral resources, however, unlike agricultural resources, are wasting assets, wasting so rapidly that not even the United States can avoid a feeling of anxiety about the future, a feeling only accentuated by the fact that the trade balance in its favour increased more than fivefold, and that the value of its total mineral output was more than doubled, between 1913 and 1918. It is significant that the United States, of all countries perhaps the wealthiest in minerals, is of all countries perhaps the most concerned about the conservation of its resources, for, as is pointed out by Dr. G. Otis Smith in the introduction to this atlas, the spendthrift of mineral wealth to-day is likely to be lacking in "independent means" to-morrow.

Consequently it came to be realized by the United States Government that any country wishing to take stock of its position from the standpoint of mineral

resources must make a careful comparison of its position with that of foreign countries. To quote again from Dr. Otis Smith, "To be adequate, any stock-taking we now attempt must include world resources and world needs; and, by balancing production against consumption, must set forth a true picture of world competition; for under the complex requirements of present-day life, no continent, not even North America, can be self-sustaining. It is no longer enough for us to make an inventory of the mineral wealth of the United States: we must supplement that inventory by a broad understanding of world demand and supply." It was in this mood that the present world atlas of commercial geology was conceived, its stated purpose being "to set forth graphically, and to describe concisely, the basic facts concerning both the present and future sources of the useful minerals." Whether the title "commercial geology" is the proper one to apply to this atlas is perhaps open to question. It includes no geology as we usually define that term, and "commercial minerals" or "economic minerals" would appear to be preferable as titles.

The minerals and metals dealt with are as follows, in the order given: coal, petroleum, oil-shale, natural gas, iron, manganese, chromium, nickel, tungsten, vanadium, molybdenum, copper, lead, zinc, platinum, gold, silver, phosphate, potash, nitrates, sulphur, pyrites, mercury, tin, antimony, arsenic, aluminium, graphite, magnesite, and mica.

Twenty or more prominent economic geologists of the United States have co-operated to produce this atlas The seventy-two plates illustrating mineral production are arranged in groups of eight, each group including (1) a world map showing productions and consumptions for 1913 by coloured vertical bars placed side by side, indicating whether production exceeds consumption or *vice versâ*; (2) maps of continents showing production by countries or districts for 1913, by means of groups of coloured dots, each dot representing 1 per cent. of the world's production; (3) a map of the United States, showing production by states or districts for 1918, by means of squares, each square being proportional to the percentage represented, and being accompanied by a figure showing that percentage.

The maps thus seek to show at a glance the distribution and relative significance of productive regions, but, as in all graphic methods, some drawbacks are apparent. The maps required are rather numerous. Where only one commodity is dealt with, the map may succeed in its object, but in some instances the method is somewhat extravagant, the detail represented being rather obscure. Instances of this are the maps showing petroleum in South America and Africa, tungsten in Africa, graphite and sheet-mica in South America, and magnesite in Oceania. Where, however, four or five commodities are shown on the same map in dots and crosses of different colours—the colours being not always clearly distinguishable, as in the case of phosphates, nitrates, potash, pyrite, and sulphur in Asia—it may be doubted whether the map is of much value as a graphic method of representation.

In spite of these minor defects, however, the atlas is very attractive and useful, and cannot fail to prove of much value to those for whom it is chiefly intended—general readers who wish to have facts presented to them in a simple way by graphic methods. T. C.

The New World: Problems in Political Geography.— Prof. Isaiah Bowman, Ph.D. World Book Company. 1921. *Maps and Illustrations.* 21*s. net.*

Prof. Bowman set himself a very big task in undertaking his 'New World,' and has carried it through with conspicuous success. The book gives a survey

of nearly all the important problems in Political Geography the whole world over. For such a task an author needs wide outlook, an immense amount of information, and a very wise selection of details. Students of Prof. Bowman's work, especially his admirable 'Forest Physiography,' have long been aware that he is one of the happy few who combine these triple powers; and he has used them with great effect in this book. Every chapter bears obvious signs of comprehensive grasp, an unwearied collection of material, and in most cases very judicious selection of details, all combined in a story made attractive and persuasive by clearness of thought and lucidity of statement.

The book is most valuable as a piece of political history, and it is of great use to have all the political history put always into its geographical and often also into its historical setting; but the difficulties were obviously immense, and not the least of them was the probability, as the author expressly states in his Preface, of "many faults of judgment and emphasis." I have a serious difference of opinion with him on one point, and that is why I do not wish to shirk my responsibility behind anonymity or the editorial plural; but I would like to say at once that, on the whole, the book is a model of moderation and sympathetic treatment. Expression of personal opinion is rare, and of personal prejudice still rarer. He does, indeed, allow himself to say definitely in regard to the Scheldt (p. 123), that "Holland has prevented or delayed improvements of the river in order that Rotterdam might profit at the expense of Antwerp"; and in regard to the occupation of Serbia by the Austro-Bulgarian forces (p. 277), "they stopped the import of food to the starving population . . . assassinated priests and teachers . . . and in some districts destroyed the entire population." But with regard to German treatment of natives in Africa, he is content simply to record (p. 200) that this "was one of the reasons which impelled the Peace Conference to take the colonies from her. The most striking case of the violation of native rights was in the Herero war."

Some idea of the magnitude of the work involved in the book may be gathered from the fact that it contains 640 pages, 6 × 9 in., with an average of fully 400 words to the page. Nearly 100 pages are filled with an admirable series of sketch-maps (215) and some pertinent reproductions of photographs (65); but even so, the text extends to well over 200,000 words. Two-thirds of this is devoted to Europe, every country being dealt with; and in nearly every case the emphasis is entirely on the right points, and the treatment is essentially sympathetic—as is suggested even by the titles of chapters: "The Democratic Drift in Spain," "The National Existence of Austria," "Land Tenure and Trade Outlets in Esthonia and Latvia."

When so much material is compressed into one volume, it is almost impossible to avoid omissions of some moment; and when a study is frankly political, it is unreasonable to demand equal attention to economic and historical details. But in both these respects Prof. Bowman maintains a high standard, partly because of his gift for suggesting, with an almost incredible economy of words, whole fields of geographical thought—"Physically Slovakia faces south, but politically it faces west;" or "Poland's history is largely the history of her landed nobility; Bohemia has been historically a land of peasant farmers."

On the political side there seem to me to be only three vital omissions in all the complicated European details, and perhaps only two; for it scarcely matters now whether or not Bohemia originally (after 1526) entered into union with Austria and Hungary on terms of absolute legal equality, even if the Czechs still remember with resentment the cynical violation of the contract.

But surely some mention should have been made of the vital geographical factor in the Belgo-Dutch question, the gut of Wielingen, where the Dutch actually claim sovereignty within the 3-mile limit of the Belgian coast; and when the Dalmatian problem was being presented—rightly, in my opinion—against Italy, the greatest care should have been taken to state the essential factor as clearly as possible from the Italian standpoint. That factor is the strategic results of the distribution of the islands, for the northern ones lie north-and-south and overlap, thus completely securing any movement of shipping along the Dalmatian coast, *i.e.* not 100 miles from the Italian coast, while the southern ones lie east-and-west, with clear gaps between, which allow uninterrupted view of any coastal movements. To this has to be added the natural action of the tide, which carries mines only from east to west, and the natural exposure to the bora, which makes the west coast much more dangerous than the east. To crown all, there is not a single harbour on the Italian coast of the Adriatic capable of sheltering the Italian navy. Not one of these points is stated clearly (on p. 261), and most of them are not stated at all.

On the economic side, too, omissions are very rare; but there are a few points in which the emphasis seems to be wrongly adjusted. For instance, the suggestion (p. 88) that France cannot restore her mercantile marine because of the cost of building ships, is irrelevant. The amount of world shipping laid up just now amounts to over 10,000,000 tons; in this country alone we have 700 boats, with a tonnage of nearly 3,000,000, laid up; and Japan has actually been buying from us modern boats (built since 1900) at 70*s.* a ton! So, on p. 76 the suggestion is adopted that Tigris water should be diverted *eastward*. But eventually the main control here, as in similar cases elsewhere, must be removed to the surrounding scarps, for only in the scarp gorges can the floods be controlled with maximum efficiency and economy. Land east of the Tigris can always be watered from the Zagros; and it is between the Tigris and the Euphrates that the raised floor of the old gulf is both most fertile and most in need of water.

Relatively the shortest section in the book is that devoted to the United States, and it is written with exceptional restraint and moderation; indeed, it even includes an interesting table (p. 561) showing that, though American theory "has disowned imperialist designs and even protested against such designs on the part of European Powers, yet in fact the tendency to expansion has been shown in an emphatic manner"—by a practical addition of over 280,000 square miles of land and nearly 17,600,000 people between 1898 and 1917, "having extended its influence and control more rapidly than any other great power, even imperialist Russia."

Much the largest section, on the other hand, deals with Britain; it is the least accurate, and the only one in which Prof. Bowman breaks his own admirable rule (p. v.) "to avoid all but the most necessary expression of opinion." Most of the blemishes are not serious, though the statement (p. 59) that the Copts form the bulk of the Egyptian population is true only if 700,000 is more than half 11,000,000; but on p. 44 there is one inexcusable assertion: "The Moslem Indian population was more or less disorderly throughout the world war. The last serious trouble occurred in April 1919, when nearly 400 natives of Amritsar were killed by General Dyer's troops *for assembling in a public square*. Therefore Indian feeling was greatly inflamed everywhere." On p. 75 there is almost a hint that Professor Bowman takes his information about us from the *Daily Herald*, yet he evidently has not gone to similar propagandist sheets for his information about other countries.

It would be a great convenience if, in the second edition, "figures" were referred to not by numbers, but by pages. In a book of this size, with nearly 300 figures, it is much easier to find, *e.g.*, p. 180 than fig. 68.

L. W. LYDE.

THE MONTHLY RECORD

EUROPE

The History of Climate in Europe.

MR. C. E. P. BROOKS, known for his researches in palæo-climatology, has a paper in the *Quarterly Journal of the Royal Meteorological Society* (July 1921) on "The Evolution of Climate in North-Western Europe," in which he traces and explains the probable climatic history of this part of the world since the last extensive glaciation of the Pleistocene, comparing that history with contemporaneous events in North America. For convenience he divides the geologically recent history of climate in North-Western Europe into the following periods: (1) last great glaciation terminating about 18,000 B.C.; (2) retreat of the glaciers, ending about 6000 B.C.; (3) continental phase (4000 B.C.); (4) maritime phase (3000 B.C.); (5) later forest phase (1800 B.C.); (6) peat-bog phase (300 A.D.); (7) recent phase. It will be recalled (*Journal*, vol. 54, p. 63) that the author favours a purely geographical theory of the primary causation of glacial epochs, and the above sequence of events is attributed mainly to changes of level, particularly in the Scandinavian region, involving alterations in the distribution of land and water, and in the circulation of the atmosphere. According to this history, therefore, the present-day climate of England has prevailed since about 300 A.D., and particular interest attaches to the two previous phases—the forest and peat-bog. The indisputable remains of great forest trees in the peat-bogs of the British Isles indicate a period when the climate of North-Western Europe was drier, less stormy, and more continental than at present, whilst the subsequent period of intense peat formation points to more humid conditions than those now prevailing. This explanation of former forest-growth is not without some practical importance, for the present-day combination of wind, wet, and cold of extensive elevated regions in Scotland, and even Ireland and England, is so severe as to inhibit trees entirely, or indeed any form of profitable agriculture. It is considered, finally, that the present phase of climate is tending again to drier conditions in connection with the continual elevation of the Scandinavian region, which may result in another Continental Phase.

The picture which Mr. Brooks presents illustrates the sequence of events during the comparatively short time which has elapsed since the Pleistocene Ice Age, and it seems desirable to point out the place of this period in the wider history of climate. The opinion seems to be gaining ground that the present zonal dispensation of climates is, geologically speaking, very recent. Lately Prof. C. F. Knowlton (*American Journ. Sci.*, October 1921) has put forward the view that only since the beginning of the Pleistocene has the Earth been sufficiently cool to permit of its surface temperature being exclusively under solar control, and that before then excessive evaporation engendered such a dense cloud-canopy that climate was largely dominated by internal terrestrial factors, so that solar radiation was not potent to establish latitudinal belts of temperature. This theory seems more reasonable than some which have been put forward. (See, for instance, this *Journal*, vol. 57, p. 196.)

ASIA

Geographical Coordinates in Central Asia.

During the expedition of Dr. De Filippi to Central Asia in 1913–14 great attention was paid to the fixing of positions by the most accurate methods available, and especially valuable results as regards longitude were rendered possible by an arrangement with the authorities in India for the transmission of wireless signals. A special object was the determination of the deflection of the plumb-line in this region by the means afforded of comparing the astronomical with the geodetic coordinates. The results of the determinations were put before the Reale Accad. dei Lincei last year by Sig. Giorgio Abetti, one of the observers, with a brief indication of the methods used, their full discussion being left to the memoir in course of publication. The number of positions thus fixed was eleven, in Baltistan, Ladak, the Karakoram, and Turkestan, those in the last including both Yarkand and Kashgar. Latitudes were determined by observations with a Troughton & Simms zenithal telescope of 63 mm. aperture, the stars being mostly chosen from the Lewis Boss Catalogue. The wireless determinations of longitude were made by means of signals from Lahore received simultaneously by observers of the Indian Survey at Dehra Dun and at stations of the De Filippi Expedition, local sidereal time being determined at each by observing the passage of stars over the meridian. The final results for four of the principal stations were as follows:

	Lat. N.	Long. E.
Skardu	35° 18′ 18″·05 ± 0″·17	75° 38′ 22″·92 ± 0″·36
Leh	34° 9′ 54″·10 ± 0″·19	77° 34′ 53″·89 ± 0″·3
Yarkand	38° 24′ 22″·22 ± 0″·31	77° 15′ 46″·02 ± 0″·65
Kashgar	39° 28′ 19″·74 ± 0″·31	75° 59′ 5″·64 ± 0″·23

These positions agree very closely with those adopted in the sheets of the Survey of India map of "India and Adjacent Countries," issued in 1917 and 1918. The position of Leh (Residency), *e.g.*, is given as 34° 10′ 6″·2 N., 77° 34′ 49″·7 E. in the letterpress accompanying Sheet 52 F.

Colonel Godwin-Austen's Sketches of India.

Some years ago Colonel H. H. Godwin-Austen, F.R.S., deposited at the Society's House a large collection of sketches in water-colour, sepia, and pencil, made during his long service in India; they were contained in a box and a large portfolio. In July 1920 he wished to see some of them, and sent a messenger to fetch away the box, intending the portfolio to remain. According to the record made at the time, and the recollection of the Society's staff, both box and portfolio were, by a misapprehension of his wishes, given to the messenger and taken away in a taxi-cab to Victoria station. A year later, in August 1921, Colonel Godwin-Austen wanted the portfolio, and it was then for the first time discovered that he thought it was still in the possession of the Society, his messenger's recollection being very definite that only the box had been taken away in the preceding year. Repeated searches have been made without result, and inquiries of the railway company and through Scotland Yard have been equally unavailing.

The missing portfolio is about 28 × 18 inches, strongly bound in black cloth, with the names Burma, Kashmir, etc., cut out of gilt paper and pasted on. It contains about 160 sketches. The Secretary R.G.S. will be very glad to receive any information which may lead to the recovery of this portfolio of sketches, whose unexplained loss has caused great anxiety to Colonel Godwin-Austen, and much regret to the President and Council.

AFRICA

French Exploration in the Western Sahara.

In the *Journal* for June 1921 we recorded (p. 471) the successful linking up of Algeria and Mauritania across the hitherto untraversed wastes of the western Sahara by the twin expeditions of Captain Augiéras from Algeria and Commandant Lauzanne from Mauritania. A graphic day to day narrative of Captain Augiéras' journey has since appeared in the *Renseignements Coloniaux* of the Comité de l'Afrique Française, 1921, No. 10. The writer begins with a useful summary of previous attempts to explore this inhospitable region. The earlier explorers include the Englishman Davidson, who in 1836 started from Southern Morocco, crossed the Dra, and pushed on into the dunes of the Igidi, whence he never returned, having, as it afterwards proved, been murdered at a place near the Wed Sus called Suekeya. Captain Augiéras identifies this spot with an old watering-place named Sheikria, now choked, which he himself passed on his journey. He made his final plunge from the north-east, on 13 December 1920, at a place called Bubut, south-west of the furthest Algerian Station of Tabelbala, supported by three platoons of the Saharan Meharists (camel corps) under the officers Ressot, Bougrat, and Gierzinski. Passing the last dunes of the Igidi the party entered the gloomy pebble-strewn desert, the Hammada of the Eglab. It was necessary to push on without missing a day, for the true direction of El Kseib, a spot on the way to the proposed rendezvous with the Mauritanian party, was unknown. The guides proved at fault, and day after day passed without a sign either of El Kseib or the escarpment of the "Hank," at the foot of which water was likely to be found. At length by changing the direction to the north-west the Hank was reached and descended, and a reconnoitring party sent out by Commandant Lauzanne was met with. It was learnt that the latter was not far off, at Mzerreb, where the junction was happily effected on Christmas Day. It was found that water emerges at many points at the foot of the Hank (which Captain Augiéras considers an immense fault, with a belt of sunken ground to the north-west), and a small lake was found at one spot, but vegetation is almost entirely absent, perhaps owing to the saline nature of the soil. From Mzerreb the Algerian party turned back under Ressot, while Captain Augiéras joined Commandant Lauzanne on his return to Mauritania by a new route. The worst part of the journey was still to come, for all the watering-places were dry, and it was only after sixteen days without drinking that the camels could be watered from the abundant supply at Aushish, which was however too salt for human use. At the advanced French post at Atar (in the Western Adrar) the two officers separated, Captain Augiéras making his way south, through country which gradually lost its desert character, to the Senegal, which he descended by canoe and steamer to Saint Louis, thus completing a sea-to-sea journey of 4500 kilometres.

Commandant Lauzanne has described the geographical results of his reconnaissance in *La Géographie* for September–October 1921, his paper being accompanied by a map. The part of the desert traversed is the home of the Regibat, a marauding tribe owning large flocks and living on the borders of Adrar, who have however been made more or less amenable to French influence, and who furnished guides for the expedition. The region is formed of three distinct zones—the broken and rocky zone of the Hank and associated scarps; a level "rag"—the Karet; and a sandy massif—the Magteir. The first collects water in its hollows, but its slopes are sterile; it provides sustenance for man, horses, and goats, but does not suit camels. The Karet is covered with pasture after the winter, but does not retain the rain-water. The dune belt

retains the water and is the chosen home of the nomads. For the basis of the map, Commandant Lauzanne determined longitudes by the help of wireless messages from Atar, and calculates that the probable errors amounted to only $\frac{1}{5}$ sec. of time. The precision of the latitude determinations, made by observations of stars with the prismatic astrolabe, was much greater still.

The Zanzibar Protectorate, 1893–1920.

A valuable summary of the principal statistics, particularly economic, of Zanzibar from the time when it became a British Protectorate has been compiled by Mr. R. H. Crofton, either from original sources or the latest official returns (London : Eastern Press, Ltd., 1921). The statistics are tabulated, with no attempt at comment or explanation, but the intelligent reader will be able himself to draw from them the resulting lessons without difficulty. Within the compass of 36 pages the pamphlet presents, first the monthly results of temperature and rainfall observations, both for Zanzibar and Pemba, from 1892 and 1899 respectively, and next the statistics of trade, shipping, finance, etc. The meteorological tables supply the raw material for a general knowledge of the climate and seasons at Zanzibar and Pemba, except in the matter of relative humidity, an element which can hardly be overlooked in estimating the influence of climate, on the white man at least. It might have been well to bring out the salient facts by means of explanatory letterpress, or at least to have worked out the means by the year as well as by the month, and also the averages for the whole period ; but some general principles are easily deduced from the figures. As might be expected, the extremes of temperature are moderate, even the absolute figures for the whole period showing a relatively small range. Thus the absolute maximum never exceeds 95° Fahr. in the Zanzibar tables, and only once reached 100° at Pemba (where the figures are generally higher). The minima, on the other hand, never fall so low as 67°. The hottest part of the year is shown to be from December to March inclusive, and the coolest from May to September ; but the difference between the mean temperatures of months within the two periods is only some 7°. The monthly rainfall totals bring out the existence of the two rainy seasons culminating generally speaking in April and May, and December, the least rainy months being February and June–to–September ; but on the average of the whole period no month shows less than an inch or two, distributed over several days. The precise incidence of the rainfall differs greatly, however, from year to year. For rainfall as for temperature, the figures for Pemba are generally higher than for Zanzibar.

The table of clove production shows great fluctuations between good and bad seasons, but there has been a general rise in average prices realized. Fluctuations of price are evidently due, to some extent, though not entirely, to differences in the amount of the crop. The returns of trade and shipping show no consistent rise in imports (given by value only) down to about 1916, since which the total has about doubled, no doubt largely owing to higher prices. The greater part of the increase is credited to the United Kingdom, British India, Kenya Colony and Protectorate, and the Tanganyika Territory, foreign countries having not shared in it. British India still stands at the head, but not so decidedly as in old days, while the Tanganyika Territory takes a higher place in 1920 than was ever taken by German East Africa. The total value of exports and re-exports has nearly trebled since 1916, somewhat exceeding that of the imports. Here British India stands only slightly higher than the Tanganyika Territory, while foreign countries take a slightly higher

place than in the matter of imports, due largely to the considerable export of copra to France. The statement of shipping engaged in the foreign trade shows that some three-fourths of the tonnage is now British, with a total greater than ever before the war, while the foreign tonnage is less than one-third of the amount in 1912 or 1913.

The African Rift-Valleys: Errata.

An unfortunate printer's error in Mr. Oldham's letter in the February number (p. 151) deprived one of the sentences of much of its point. Line eleven should read: "or showing a *deficit* considerably less than the excess on the scarp." In the review of Prof. Gregory's book in the same number (p. 141) the price should have been given as 32*s. net.*

AMERICA

The Longitude of Caracas.

A report by the *Oficina de Cartografia* of Venezuela on a new determination of the longitude of Caracas appears in the Scientific Supplement to the official *Boletin Comercial e Industrial* for 1 March 1921. The observations were made at the office of wireless telegraphy on fourteen different dates between February 19 and May 12, a Troughton & Simms theodolite and two chronometers by Liverpool makers being employed for the determination of local time, that of Greenwich being obtained by picking up the wireless signals from Washington and Panama. On each occasion equal altitudes of at least two pairs of stars were taken, but in the majority of cases the number of pairs was from four to seven. The longitude as obtained by the two chronometers was worked out separately, the mean being taken as the final value, since the probable error of $\pm 0^{s}.12$ s. was the same for both. After allowing for the difference in longitude between the observation station and the Observatory the longitude in time obtained for the latter was 4 h. 27 m. 43^{s}.25 s., or 0^{s}.07 s. less than that obtained by cable and telephone in 1906. The new longitude in arc is thus 66° 55′ 48″.74 W. Unfortunately the behaviour of the chronometers was not entirely satisfactory, but it is hoped to obtain better instruments, and to repeat the observations on a future occasion. The report includes full details of the observations.

POLAR REGIONS.

Mr. Ponting's 'Great White South.'

We regret that a statement not strictly correct was made in the review of Mr. Ponting's book in the February number. The reviewer said that most of the illustrations had already appeared in 'Scott's Last Expedition,' trusting evidently to the general impression created by seeing so many of the pictures familiar to readers of the latter work repeated in Mr. Ponting's. We are informed by the publisher that the exact number of those repeated is 71 out of a total of 175 (*i.e.* somewhat less than half), so that strict accuracy required the use of "many" in place of "most."

GENERAL

The World's Cotton Supply.

The present over-stocked condition of the market in raw cotton does not by any means prove that new sources of supply will not be urgently needed in the not distant future. Such is the opinion expressed by Mr. W. H. Himbury, in a paper presented last year to the World Cotton Conference, and since printed

as a publication (No. 75) of the British Cotton Growing Association, of which Mr. Himbury is general manager. The paper treats of the "Exploration and Development of New Cotton Fields within the British Empire," and presents a useful summary of the results of efforts in this direction, especially in Africa, within the past twenty years. It is pointed out that before the war there was a shortage of supply of many thousands of bales, and this was increasing annually. With the return of normal conditions this shortage is bound to recur, more especially as the United States requires a constantly increasing proportion of her own crop for domestic use (59 per cent. in 1917–18, as against 31·2 per cent. in 1895). Cotton has an advantage over many other tropical products in that it is valuable enough to bear transport charges, whilst by improving the condition of the natives who help to grow it we are providing ourselves with potential customers for our manufactured goods. The early attempts at cotton-growing in Africa were largely experimental, and have not always succeeded, but the facts presented by Mr. Himbury show that in several of the British Protectorates such progress has been made as to leave little doubt of continued success. Much everywhere depends upon transport facilities, and further railway development is needed. But it is held that railways in any district in Africa will pay their way, and are needed for general economic development and not only for the transport of cotton. The fields which at the moment give the greatest promise are Nigeria, the Sudan, and Uganda, in the last of which cotton already forms 80 per cent. of the total exports, so that it may be claimed that it is mainly owing to cotton that Uganda has become self-supporting, whilst in Nigeria too it has been one of the chief factors in making the railways pay. Other possible fields exist in India, Mesopotamia, and elsewhere.

In this connection the project for the extension of irrigation in Sind—one of the few parts of India except the Punjab where suitable long-stapled cotton can be grown with success—is of interest. The question was discussed last year before the East India Association by Dr. T. Summers, who for many years has urged such extension of irrigation by water from the Indus. Opinions have differed as to the best means for attaining the desired end, some favouring the immediate construction of a barrage at Sukkur (a scheme which has been provisionally approved by the Secretary of State), while others, Dr. Summers among them, consider that the cost of such a barrage will be excessive, and that the first work which should be carried out is the Rohri canal, to be followed by others, and possibly in course of time by a barrage. It is held, too, that the site proposed for the barrage is ill chosen, and that disastrous results might ensue through the possible breaking of its banks by the Indus above the barrage. The general feeling of the meeting seems to have been entirely with Dr. Summers in his criticisms of the official scheme.

While the above enterprises are wholly British, other nations too are casting about for means of providing their requirements in cotton from their own colonial possessions. France sees a promising field for cotton-growing in the region of the Upper Niger, where great possibilities in the way of irrigation are said to exist. The subject has been very thoroughly studied on the spot by M. Bélime, under the auspices of the Government of French West Africa, and a valuable report has been published. It is summarized in the *Renseignements Coloniaux* of the Comité de l'Afrique Française, 1921, No. 10, together with an excellent map and an introductory article by General Hélo. The complicated hydrographical conditions in the Niger valley between Bamako and Timbuktu are lucidly described and suggestions made for the construction of irrigation

canals, especially one on the south side of the river in the neighbourhood of Segu. The questions of labour-supply and transport are duly considered, and the conclusion is reached that the difficulties to be encountered in West Africa are far less than those that have been faced with success in Russian Turkestan.

Elephant Grass for Paper Making.

In a paper read before the Society of Arts in May 1915 and summarized in the *Journal* for the following August (vol. 46, p. 160), Mr. S. C. Phillips considered the resources of the British Empire in paper-making materials, and after treating of the wood-pulp which at present forms the bulk of the material used, spoke of possible sources of supply in the bamboo, papyrus, and other reeds and grasses supplied by India, Africa, and Australia. The question of utilizing the latter class of material for the needs of the tropics is once more taken up in a recent issue of the *Bulletin* of the Imperial Institute, and reason is given for believing that the efforts in this direction may be successful, both the yield of pulp from the giant grasses of the tropics and sub-tropics and the quality of the paper made being said to be satisfactory. In particular the "elephant grass" of East Equatorial Africa has been tried on a large scale, and the paper made from it in Uganda, and used for Government printing paper, has proved of excellent quality. The use of such materials in the tropics would at least do away with the anomaly of sending thither wood-pulp from temperate regions, for the needs of which the supply is already inadequate, even if the former might not repay transport to Europe in bulk.

The Institute of Historical Research, University of London.

We are glad to call attention to the excellent work being done or projected by this recently formed Institute, which has its home in Malet Street, Bloomsbury, conveniently near to the British Museum. It already possesses the nucleus of a collection of maps and works of reference in its own rooms, so that facilities for research are available. A subject that is now being taken up under the direction of Prof. Arnold J. Toynbee is the study of Western Influence on Near and Middle Eastern peoples, for it is felt that the history of this influence during the last two or three centuries is one of the keys to present Oriental problems. The narratives of Western travellers provide an admirable field for such studies, and one which has not yet been worked systematically. It is hoped to bring together at the Institute a group of people who may collaborate in the study, concentrating their attention in the first instance on peoples and countries that have been included in the Ottoman Empire, and starting, in time, from about the last quarter of the seventeenth century. Prof. Toynbee appeals for such collaborators, and will be glad to give further information to any interested in the scheme.

The 'Indian Antiquary.'

This well-known magazine, which has numbered among its contributors many prominent scholars in India, Europe, and America, has lately celebrated the fiftieth anniversary of its first publication. To mark the event, Sir Richard Temple, Bart., who has been the Editor-proprietor for thirty-seven years, has written a short history of the magazine, a copy of which he has sent us. Its main object has been to provide a means of communication between East and West on matters of Indian Research, which it has consistently studied to promote. The subjects treated have been very varied, though generally concerned more or less with the past, and besides archæology in the more restricted sense, geography, ethnology, language, religion, and many other branches of study

have received due attention. The Editor is to be warmly congratulated on the success achieved by the paper to which he has devoted so many years' assiduous labour.

OBITUARY

Sir John Kirk, G.C.M.G., K.C.B., F.R.S., M.D., LL.D., D.Sc., D.C.L.

SIR JOHN KIRK, who died in his ninetieth year at his home in Sevenoaks on 15 January 1922, was born on 19 December 1832 at Arbroath, on the coast of Forfarshire, the second son of the Rev. John Kirk, a minister of the Church of Scotland.

Early in boyhood he evinced an interest in botany, but as in those days a career as a biologist was not possible to any one but a person of wealth (when it became an amiable amateur pursuit), he decided (or it was decided for him) that he should strive to become a doctor of medicine. He went to Edinburgh University when not much over fourteen years of age and studied there for more than six years, enthusiastically working at botany. At the age of twenty-two he graduated at Edinburgh as M.D. and L.R.C.S., and soon afterwards felt impelled to volunteer for medical service in the Crimean War. He was accepted, together with nineteen other young Scottish doctors of medicine or surgeons, and became a physician at the Renkioi hospital on the Dardanelles. He spent nearly three years in Asia Minor, giving up his leisure time to the study of Asia Minor botany. In 1857 he had returned to England, to proceed with an earlier-formed intention of going out to a Canadian university to teach zoology and botany, when he heard of Livingstone's projected expedition to the basin of the Zambezi River.

He was consulted at Edinburgh as to the choice of a naturalist possessing a medical degree who might accompany Livingstone's Second Zambezi Expedition, and proposed himself. He was so obviously suitable that he was at once accepted, and was probably ranked third in the hierarchy of the expedition, the second in command to Livingstone being Commander Bedingfield, R.N. But Bedingfield left the expedition in a huff shortly after arriving at the Zambezi delta, and though there may have been no formal appointment at the time, Dr. Kirk succeeded him as second in command. Charles Livingstone, the leader's brother, may at first have been considered to rank equally with Kirk. He accompanied his brother David and Kirk on all their earlier great journeys up the Shire and up the Zambezi to beyond the Victoria Falls; he did not finally leave to return to England till the early spring of 1863. Two years afterwards he was appointed to the British Consulate of Fernando Pô, which in those days watched over British interests in the Niger Delta and the Cameroons. But although the work of Charles Livingstone has certainly been undervalued and ignored (he was part author of Livingstone's 'Zambezi and its Tributaries'), it is clear that before the expedition had made much progress, Kirk had been regarded as its second in command, with no objection on the part of Livingstone's brother. Kirk was emphatically the scientific member of the party, in regard to its collections in botany and zoology, and not infrequently the leader of its adventurous essays in bold exploration. He lost some of his valuable collections in accidents of transport, being several times nearly drowned in capsizing canoes on the Zambezi "Quebra-baço" rapids, near Tete, and what have since been termed the Hamilton Falls of the Shire River. But nevertheless his work enormously increased our knowledge of the

flora of Nyasaland and Zambezia. His most important collection of plants, which had taken him two years to amass, was sent to England from the mouth of the Zambezi in one of Her Majesty's ships, and was shunted into a naval store or depôt at Portsmouth. Here it lay for nearly *thirty* years, until the store was turned out in 1890. The writer of this memoir was visiting Kirk at Sevenoaks somewhere about the time of the rediscovery, and well remembers his quiet joy—all his expressions of his feelings were quiet—at his justification ; for on examination the specimens were found not to have suffered appreciably for their long seclusion, and they have materially contributed to the record of the 'Flora of Tropical Africa' which Lord Salisbury about this time was arranging to publish through the Stationery Office.

It was during the two and a half years' stay in England (1863-65) that Kirk met Miss Helen Cooke and became engaged to her. He was offered a high post at the Royal Gardens, Kew, under his friend Sir Joseph Hooker, but he desired so much to return to Africa that he declined the appointment and accepted the rather meagre alternative of medical officer to the Zanzibar Agency, and proceeded to his post in January 1866. Miss Cooke travelled out to Zanzibar *viâ* the Seychelles Islands, and was married to him in 1867. The consular and medical appointments at Zanzibar in those days—and, I think, till about 1880—were conferred by the India Office. Kirk was made a Vice-Consul in April 1866, and Assistant Political Agent in 1868. Owing to a variety of causes, between his arrival at Zanzibar in 1866 and the summer of 1873, he was generally left in supreme charge of affairs in that Arab Sultanate, the titular Agent and Consul-General being either an invalid or an absentee. It was during this period that his old "chief," Dr. Livingstone, was making those last wonderful journeys in inner East and Central Africa which were to reveal the sources of the Congo and the limits of Tanganyika. Kirk was in the invidious position of being frequently appealed to by friends of Livingstone to forward up-country by unaccompanied native porters supplies of stores to the vaguely situated Livingstone. Stanley arrived, disguised as a mysteriously moving American. Stanley returned, leaving Livingstone as near Zanzibar as the Unyamwezi country. Livingstone died just as British relief expeditions were starting to bring him back to the coast and complete his amazing discoveries of the Upper Congo and its great lakes.

Coincident with these developments, affairs at Zanzibar were reaching a climax. The Sayyid of Zanzibar, miscalled then the "Sultan," had to decide to dissociate his rule from an aboundingly bad slave trade, in pursuit of which his subjects were devastating East Africa. Kirk won. He persuaded this Arab chieftain to sign the Anti-Slavery Agreement, and afterwards brought him to England to make Queen Victoria's acquaintance. The success of this visit was so great, that from Kirk's return in 1876 he ruled the Zanzibar dominions through the Maskat Arab Dynasty. The slave trade still continued, but it had become illegal, and short and sharp measures could be taken to put it down.

Unfortunately French jealousy under the Second Empire had brought about the signing of a treaty or agreement in the early 'sixties which bound both Powers, Britain and France, to abstain from any political sway over the East African coast between southern Somaliland and the Portuguese dominions of Moçambique. So that as an alternative to barbarity and misrule there was no other course open to us than to endeavour to assist the Zanzibar Sultanate to control the East African region between Somaliland, the Nile basin, the Great Lakes, and the Ruvuma River. Kirk therefore set himself with patience

and consummate skill to educate the open-minded "Sultan" of Zanzibar—the celebrated Barghash bin Sa'id—to compose his differences with other Arab clans on the mainland and to rule by council and intervention the motley Negro tribes over Equatorial East Africa. With the approval of the Foreign Office he placed British consular officers at the leading ports and stirred up the Council of the Royal Geographical Society to dispatch expeditions under competent explorers like Joseph Thomson. He was more or less the promoter of the Kilimanjaro expedition of the Royal Society and the British Association which I conducted in 1884. The Foreign Office had taken a great interest in this expedition, and afforded me a good deal of assistance. I had previously travelled considerably in North Africa and in West Africa, and had been enabled by Stanley to visit the Upper Congo at a time when it was virtually unknown. Stanley had lent me a number of Zanzibari porters from whom I had learnt Swahili, so that when in the following year (1884) I reached Zanzibar I could speak that language with tolerable correctness. This fact delighted Kirk, and perhaps specially inclined him to show me favour and take a strong personal interest in the equipping of my expedition. Zanzibaris whom he recruited for me then continued to serve me on my succeeding East and Central African adventures till I retired from the administration of Uganda in the opening years of the present century.

Before I left Zanzibar to travel through a then very little known East Africa to the highest of its mountains, there were already rumours afloat as to the intentions of the German Government. Kirk had done so much from 1866 onwards to help the Hamburg Germans to develop their trade with Zanzibar—as he similarly helped most European nationalities, the United States, and the Indians of British India, for he was very emphatically a Free Trader—that he was for a long period, down to about 1883, Consul at Zanzibar for the Hamburg republic, just as he was Consul-General for Portugal and (I think) also for Italy. But in the summer of 1884 a German war vessel brought out the explorer Gerhard Rohlfs to be Consul-General at Zanzibar. Rohlfs assumed an almost impossible attitude of domination, and demeaned himself as though Zanzibar had already been allotted to Germany. Kirk nevertheless kept his temper; but when Carl Peters, Count Pfeil, and other unofficial Germans were striving to make treaties with the native chiefs of the interior, he advised me of this, and counselled my securing British and Zanzibar interests on and around Kilimanjaro. Elsewhere he took similar steps, and when in 1885 negotiations between the two Governments began, British interests were substantially protected.

Bismarck insisted on the withdrawal of Kirk, however, and he retired from his great post in the middle of 1887. How severe a loss his retirement was to British and German interests in East Africa we did not realize for some years afterwards. Had he been encouraged to remain, it is possible that the British task would have been far more easily and satisfactorily mastered between Mombasa and Uganda; and the widespread revolt against the Germans might never have taken place.

Kirk returned to England in 1887 to live at his charming home on the outskirts of Sevenoaks, with his wife and a family of six children (all but one of whom were born in Zanzibar). It may not perhaps be indiscreet to say—after this lapse of years—that this family was remarkable for its good looks, its talents, and charm; and that the deaths of two of their daughters some twenty years ago were the only great sorrows that came into their parents' life. Lady Kirk herself died in 1914. Sir John Kirk's only son fortunately has survived

to pursue a distinguished career in the army down to the close of the last war in 1919. In addition he has also been a student of East Africa, especially of Somaliland and the Somali language. His father, though he was withdrawn from Zanzibar to satisfy the arrogance of Prince Bismarck, continued to serve the British Empire under the Foreign Office in various ways, mostly in connection with the building of the Uganda Railway, and at European Congresses dealing with African affairs. He travelled extensively through Europe from Norway to Southern Spain, from Belgium to the Black Sea; and in 1903 revisited Zanzibar and journeyed to the Victoria Nyanza along the Uganda Railway. These activities drew to a close in 1907, owing to the impairment of his sight. As far back as the beginning of the 'eighties the sight of one eye had been increasingly affected. Nevertheless he had pursued photography in almost all its branches, with a skill which in some directions amounted to perfection. But reluctantly photography had to be given up about thirteen years ago. As far as I remember, Sir John Kirk's last noteworthy appearance in public was at King George's Coronation service. He was then so nearly blind that he had resigned his long-held position of Foreign Secretary to the Royal Geographical Society. H. H. JOHNSTON.

Sir Ernest Henry Shackleton, C.V.O., O.B.E.

Sir Ernest Shackleton's death on January 5, at the very outset of a new expedition, removes the last of three great Antarctic explorers of this century. Scott, Bruce, and Shackleton by their qualities of fine courage and endurance and devotion to science have succeeded in placing their country in the forefront of Antarctic exploration. In their different ways they widened the bounds of knowledge, they set an example of heroism, and they created romance for the generations to come.

Shackleton was born in Ireland in 1874, and spent the early part of his life in that country. By descent he was not an Irishman, however. His school was Dulwich, but the call of the sea had lured him away before he was sixteen. He served before the mast in various sailing ships, in due course took his mate's certificate, and finally became an officer in the Union-Castle Line. His experiences in one of that company's troopships during the South African war were published under the title 'O.H.M.S.' Shackleton at this period must have been a curious blend of practical seaman and poet.

At this time the *Discovery* Expedition was being fitted out for Antarctic work. It was intended to be purely naval, but finally the personnel included two officers of the Mercantile Marine. Of these Armitage had had previous Arctic experience, while Shackleton secured selection by sheer persistency and force of character. The account of the expedition shows that from the first Shackleton looked like coming to the front. That he was soon made editor of the *South Polar Times* was a tribute both to his personality and to his literary instincts. In those days, as always, there was keen competition to be included in the southern party: it was on Wilson and on Shackleton that the choice finally fell. This, the pioneer long sledge journey in Antarctica, was not so successful as Scott had hoped. First one, and then all three, developed scurvy. Even after the symptoms were first discovered, the party pushed on southwards for another week. It was a big risk, however, and on the return journey Shackleton came very near death: Scott refers in admiration to his fierce determination to keep alive. As a result of his illness Shackleton was sent home on the relief ship *Morning*, and thus missed participating in Scott's great western journey the next year.

Shackleton had now found his vocation, and he was soon planning an expedition of his own, which aimed at reaching the South Pole itself. In common with his other expeditions, it was essentially a private venture, and started without state aid of any sort. Shackleton, as would be expected by those who knew him, at once broke with tradition. The ship was not to winter, ponies would be used, and motor haulage would be given a fair trial. Winter quarters were established at Cape Royds in January 1908. Owing to the situation of the hut, no depôts could be laid out in the autumn; instead, a party led by Prof. David made the first ascent of Mount Erebus. The southern journey was begun at the end of October, the one and only supporting party being sent back when but 38 miles south of Hut Point. The depôt laid in the spring in 79° 36′ S., 150 geographical miles from winter quarters, was picked up on November 15. If all went well, the odd 700 miles from there to the Pole were within the compass of the party. Four weeks later Shackleton, Wild, Marshall, and Adams had discovered and were climbing the Beardmore Glacier to the plateau. On January 9 they were within 100 miles of the Pole. But for the loss of a pony down a crevasse they would probably have reached their goal. As it was, all Arctic and Antarctic records had been broken, the Antarctic by nearly 400 miles. To have gone on a day longer would have meant the death of the whole party. Even then they left the narrowest of margins; on one occasion they were forty-eight hours without food. The story of the return march of seven weeks is a record of magnificent courage and endurance. The daily average was at first 20, then 10–15 miles on three-quarter rations. At the very end of it all Shackleton performed the astounding feat of going back with the relief party for the two members who had broken down. By so doing he covered 100 miles without proper rest on top of a 1700-mile journey. This sledge journey is now regarded as the greatest feat of its kind either in the Arctic or in the Antarctic. Together with Prof. David's march to the South Magnetic Pole it fired the public enthusiasm, and Shackleton's reputation as an explorer was made. Honours were showered upon him, including knighthood, and the Special Gold Medal of this Society.

During the next few years his thoughts were continually turning towards the south. As can be read in the Introduction to 'The Home of the Blizzard,' it was Shackleton who initiated the Australasian Antarctic Expedition, but it was finally organized and commanded by Sir Douglas Mawson. He himself did not return to the Antarctic till 1914. The pole had by then been reached by both Amundsen and Scott. Shackleton's new venture had as its object the still more ambitious plan of crossing the continent, a conception quite sound, but nevertheless not destined to be realized. The Ross Sea party did all that they were set to do, and laid a depôt at the foot of the Beardmore Glacier. In the Weddell Sea, however, Shackleton's good fortune deserted him, and a combination of adverse circumstances ended in his ship being beset. After drifting helplessly for nine months, she was finally crushed and sunk. The narrative of how the shipwrecked party ultimately extricated itself from what appeared a hopeless position is of epic character. The story fortunately has been adequately told; and in these chapters of 'South' Shackleton's powers as a writer are shown at their very best. It is left for others, however, to record how the successful ending of a year's wandering must be directly attributed to the personality of the leader. When difficult decisions had to be made, Shackleton invariably made the right choice. His uncanny prevision became a byword. The last and most difficult decision of all was taken when he placed the main party under Wild's charge, and himself

went to seek relief. Had he failed, his action might easily have been misconstrued. Events justified his decision, and in the end he triumphantly rescued the Elephant Island party. It is doubtful if there is any parallel to these adventurous months. Few explorers have had such demands made on their powers of organization and of leadership: and those few have generally failed.

On his return in 1917 Shackleton threw himself into the war. After being first of all sent on a diplomatic mission to South America, he was finally chosen to give advice to the troops on the North Russian Front. His friends knew, however, that he would have liked to have figured in a fighting unit. His attitude to the national emergency is expressed in a recruiting speech made in Australia in 1917, from which the following may be quoted: "To take your part in this war is not a matter merely of patriotism, not a matter merely of duty or of expediency: it is a matter of the saving of a man's soul and of a man's own opinion of himself."

The 1914–1917 Expedition had returned heavily burdened, but Shackleton set himself, as he had done on the previous occasion, to pay off the debt by means of lectures and the sale of his book. While still lecturing on the experiences of the *Endurance* party, he was already making plans for a new venture. He had always longed to visit the Beaufort Sea, but in the end he had to change his mind; and when the *Quest* sailed in September 1921, it was with the intention of discovering the unknown coast west of Enderby Land and of exploring the little-known sub-Antarctic islands. Islands had always appealed to his romantic and imaginative nature. There is no more fitting burial place therefore than South Georgia, one of the least known of these islands, and the one moreover where he accomplished one of his greatest exploits.

Shackleton possessed in unusual measure the highly poetic imagination which is traditionally associated with a love of exploration. It is well expressed in his writings and in the naming of his ships; occasionally even he would produce some lines of original poetry. Those on Mount Erebus are probably the only ones published. His wonderful memory made it easy for him to have ready a line of verse suitable to almost every occasion. It would generally be from Browning, his favourite poet. Once started, he might go on quoting him for hours from his well-stored memory. When combined with great physical strength and with powers of leadership, a nature of this sort is the very stuff from which the great explorers are made. Shackleton, indeed, possessed the faculty of leadership to a pre-eminent degree. That, together with his generosity, made all the best men who had served with him his staunch adherents. They had implicit faith in his judgment. Shackleton's was the rarer type of courage which is controlled rather than rash. Two of his greatest decisions—to turn back on the southern journey, and to remain on the ice after the *Endurance* was crushed—are examples of his caution. In the first case he had to fight down his own ambition; in the second he had to face the adverse criticisms of some members of his party. Caution and shrewdness were combined, however, with invincible optimism; this made him a trying partner at card games, and was also responsible for a continual hankering after and belief in hidden treasure. The latter feature was but another instance of his romantic nature. It was perhaps this which first suggested to his intimates a likeness to Raleigh. Then his friends found that he was a Raleigh in many ways—courtier, poet, explorer, and lover of his country. In an age which is producing modern Elizabethans Shackleton will surely be reckoned as most true to type.

J. M. W.

CORRESPONDENCE

The Mekong–Salween Divide.

In the November *Journal*, Major Rigby, commenting on my paper "The Mekong–Salween Divide as a Geographical Barrier" (July *Journal*), makes some interesting remarks on the distribution of the elephant and other big game east of the Salween river. I need hardly add that any such observations, whether tending to support or conflict with a tentative theory such as I put forward, are most welcome.

When I wrote the paper referred to, I had not crossed the Mekong–Salween divide south of the Bhamo–Ta-li-fu route (latitude 25° 10′ north). Since then (in April 1921) I have traversed the country between Lashio and Mêng-hua, crossing the divide in about latitude 24° 30′ north, where, as regards flora at any rate, it certainly retains to a considerable extent its character as a geographical barrier.

The big game referred to by Major Rigby, south of Ssŭ-mao and east of the Mekong river, is so far south (latitude 22°–23° north) that it is fairly obvious it must have derived originally from Tonkin, and not from the west. As I stated in my original paper: "We have no evidence of its (the Mekong–Salween divide) nature as a barrier. South of latitude 24° the mountains rapidly dwindle in altitude. . . . South of the tropic the fauna at least has found no difficulty in spreading east and west." However, Major Rigby has kindly supplied one piece of evidence. Another piece of evidence, by no means favourable to my theory, came to light this summer, when I heard the barking deer, or at any rate some deer making a precisely similar sound, far east and north of the Mekong. I did not, however, see the animal. But to suppose the Mekong–Salween divide, even in its most formidable aspect, to be a perfect barrier would be against all reason.

Chiefly I recognize in the Mekong–Salween divide a barrier bounding the great Burma–Assam enclave, pinching up and to some extent isolating the Oriental fauna and Indo-Malayan flora where these try to get round behind the eastern end of the Himalaya. East of the Salween, the only corridor up from the south is the Mekong gorge, which is too narrow to serve as a highway of migration. East of the Mekong, the whole of the Yun-nan horst (if that is the correct word) blocks access from the south and south-east.

F. Kingdon Ward.

T'eng-yuek, Yun-nan, 24 December 1921.

Remains in Uganda: Possibly Maanthinle.

Mr. R. E. Salkeld's very interesting letter, dealing with the inhabitants of Jubaland, that appeared in your issue for last November, opens up an attractive field of research. It may be of interest to workers in Eastern Africa to know that in Uganda we have remains which, judging from Mr. Salkeld's account, are similar to those of the Maanthinle occupation of Jubaland.

I have discovered artificial water-holes (usually on hilltops) and remains of fairly extensive irrigation works (in northern Buddu) associated with middens in which the quantity of pottery and bones, other than those of man, is remarkable. Stone cairns are known, and said to extend southwards into the Tanganyika Territory; while some old forts, consisting of very extensive earthworks and trenches, exist near the Katonga River. In addition to this, ancient shafts (probably the relics of mining operations) and wells have been

seen, while evidence exists to show that the game of *Mweso* (*Mbao*) was played in Uganda a good many centuries back. It may also be mentioned that made-earth beds at Kibiro, the salt centre on Lake Albert, indicate a lengthy occupation of this site.

The forts (Biggo bya Mugenyi) have a legendary history: they were built, it is said, by "the stranger" who, according to the generally accepted view, came from Abyssinia. The mine-shafts figure in local folk-lore. The forts have recently been mapped, and the mine-shafts investigated by Field Officers of the Geological Survey during the course of their work, the results of which will be available this year. Whether these remains have any connection with the Maanthinle is problematical, but the possibility of such a connection is not remote, and might be investigated with advantage.

E. J. WAYLAND.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1921–1922

Seventh Evening Meeting, 6 February 1922.—The President in the Chair.

ELECTIONS.—Charles Chaney Baker; Major Hugh Ashley Brereton; Malcolm Addison Bright; Arthur F. F. Broodbank; Henry W. J. Bucknall; Major Arthur D. Budd; Rev. Tom Llewellyn Gomersall, M.A., L.TH.; Harry Revell Harmer; Henry Harvey; Theodore Hunt Hedley; Captain Geoffrey Redaway King; Arnold Lunn; Captain Walter MacGrath; Mrs. M. Katherine Marshall; Captain Thomas Patrick O'Kelly, M.C.; Herbert John Stewart Pinn; Captain Cecil Damer-Priest; Rev. Joseph Edward Rockliff; James Alfred Sinclair; Captain William E. Southgate, M.A.; Charles William Smith, B.A.; Harry N. Steptoe; Mrs. Francis E. Storrs; Captain Roy D. Thexton; Edward Rowland Weare; Miss Mary E. Wedgwood, M.B.E.; Major E. O. Wheeler, M.C., R.E.

PAPER: Byways in Hunza and Chitral. Brig.-General G. K. Cockerill, M.P.

Eighth Evening Meeting, 20 February 1922.—The President in the Chair.

ELECTIONS.—I. Mitford-Barberton; Captain F. Brian Bibby; Harry James Brown; Flight-Lieut. Douglas Colyer, R.A.F.; William Richard Corke; Sub-Lieut. Maxwell Cunningham, R.N.; Captain Clement Gillman; Major-General Lionel Charles Dunsterville, C.B., C.S.I.; George Francis Gloster; J. S. Granville Grenfell, M.A.; Mrs. Rosamond E. Sylvia Gubbins; Samuel Lister James; Robert Charles Horace Jenkinson; S. V. H. Lassen; Walter Slade Long; Thomas Edward Maddox; James Herbert Morrish; Miss Christine Norton; Prof. Edward Odlum, M.A., B.SC.; Rev. John George Perdue, M.A.; R. Rait Rattray; Lady Rogers; Percy Austin Skinner; Vivian Smith; Robert Arthur Staniforth; Lieut.-Commr. Albert Sigismund Elwell-Sutton, B.A.; Miss Eva G. Rimington Taylor, B.SC.; Hon. Mrs. Tennant; Rev. William Heward Murray Walton, M.A.; Miss C. Islay Wood.

PAPER: Natural History of South-Western Tibet. A. F. R. Wollaston.

Fourth Afternoon Meeting, 13 February 1922.—The President in the Chair.

PAPER: Stereographic Survey. Lieut.-Colonel M. N. MacLeod and A. R. Hinks.